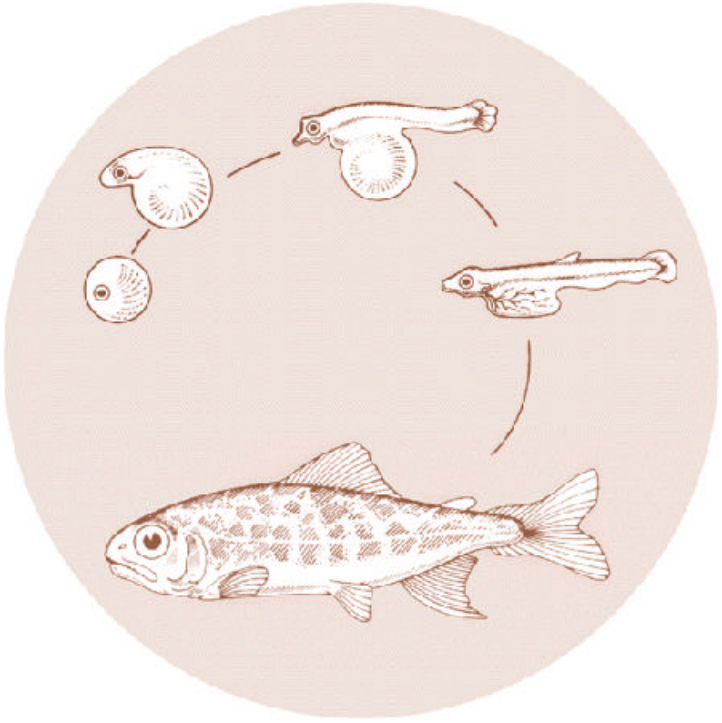
January 2001

FISHERY RESEARCH
STEELHEAD SUPPLEMENTATION
IN IDAHO RIVERS

Annual Progress Report January 1, 2000 - December 31, 2000



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FISHERY RESEARCH

STEELHEAD SUPPLEMENTATION IN IDAHO RIVERS

ANNUAL PROGRESS REPORT
January 1, 2000 – December 31, 2000

Prepared by:

Alan Byrne
Senior Fishery Research Biologist

IDFG Report Number 01-15
January 2001

STEELHEAD SUPPLEMENTATION IN IDAHO RIVERS

Project Progress Report

2000 Annual Report

By

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ABSTRACT

In 2000, we continued our assessment of the Sawtooth Hatchery steelhead stock to reestablish natural populations in Beaver and Frenchman creeks in the upper Salmon River. We stocked both streams with 15 pair of hatchery adults and estimated the potential smolt production from the 1999 outplant. I estimated that about nine smolts per female could be produced in both streams from the 1999 outplant. The smolt-to-adult return would need to exceed 20% to return two adults at this level of production.

In the Red River drainage, we stocked Dworshak hatchery stock fingerlings and smolts, from 1993 to 1999, to assess which life-stage produces more progeny when the adults return to spawn. In 2000, we operated the Red River weir to trap adults that returned from these stockings, but none were caught from either group.

We continued to monitor wild steelhead populations in the Lochsa and Selway river drainages. We estimated that 26 wild adult steelhead returned to Fish Creek. This is the lowest adult escapement we have documented (when the weir was intact all spring) since we began monitoring Fish Creek in 1992. I estimated that nearly 25,000 juvenile steelhead migrated out of Fish Creek this year. Juvenile steelhead densities in Lochsa and Selway tributaries were similar to those observed in 1999.

In 2000, we obtained funding for a DNA analysis to assess Idaho's steelhead stock structure. We collected fin samples from wild steelhead in 70 streams of the Clearwater, Snake, and Salmon River drainages and from our five hatchery stocks. The DNA analysis was subcontracted to Dr. Jennifer Nielsen, Alaska Biological Science Center, Anchorage, and will be completed in 2001.

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INTRODUCTION

The Steelhead Supplementation Study (SSS) was designed to assess the effects of supplementation on wild fish stocks. A detailed experimental design for this project was submitted to Bonneville Power Administration in 1992 and fieldwork began in 1993 (Byrne, 1994). This report documents the work we did from January 1, 2000 to December 31, 2000. Previous reports have summarized the work we performed before January 1, 2000 (Byrne 1996, Byrne 1997, Byrne 1999, and Byrne 2001). In 2000, we focused our effort on three objectives:

Objective 1: Assess the performance of hatchery and wild brood sources to reestablish steelhead in streams where expirated.

The original plan was to assess the performance of a hatchery stock with a wild stock with a paired watershed study in tributaries of the upper Salmon River. This approach was not done because wild steelhead abundance declined and Idaho Department of Fish and Game (IDFG) decided that "mining" wild stock for this experiment was not appropriate. Wild steelhead were subsequently listed under the Endangered Species Act (ESA) in 1997. In 2000, we stocked hatchery adult steelhead that returned to the Sawtooth Fish Hatchery and assessed the juvenile production of the adults we stocked in 1999 with a snorkel survey of the streams.

Objective 2: Evaluate the ability of returning adults from hatchery smolt and fingerling releases to produce progeny in streams.

This objective was done in the Red River drainage, a tributary of the South Fork (SF) Clearwater River with Dworshak hatchery stock. Fingerlings were stocked yearly in the SF Red River from 1993 to 1996. Smolts were stocked in Red River in the spring from 1996 to 1999. In 2000, we operated the Red River weir to identify and count returning adults and assessed juvenile density with a snorkel survey of the streams. Adult returns from the fingerling and smolt stockings are expected to continue until 2003.

Objective 3: Assess the abundance, habitat, and life history characteristics of existing wild and natural steelhead populations in the Clearwater and Salmon river drainages.

We assessed juvenile steelhead abundance with snorkel surveys during the summer in tributaries of the Selway and Lochsa rivers, Passive Integrator Transponder (PIT)-tagged wild steelhead throughout the Salmon and Clearwater River drainages, recorded stream temperature, and estimated escapement of wild fish in Fish Creek.

We initiated a new task this year to determine the evolutionary significance and genetic population structure of Idaho's steelhead assemblage using PCR amplification of 10 microsatellite genetic markers. We collected fin samples from wild juvenile steelhead throughout Idaho and from our hatchery stocks. We have subcontracted the DNA analysis to Dr. Jennifer Nielsen at the Alaska Biological Science Center in Anchorage.

METHODS 2000

Objective 1

Collecting and Outplanting Adult Steelhead

Idaho Department of Fish and Game personnel stocked hatchery adult steelhead that returned to Sawtooth Fish Hatchery in Beaver and Frenchman creeks on April 13, 2000. Hatchery adults that were outplanted were randomly sorted from fish that returned to the Sawtooth Fish Hatchery. The adults were sexed and their fork length was measured to the nearest cm. The adults were trucked to the creeks, placed in large Coleman coolers filled with water, transported to the study site with snowmobiles, and distributed throughout the 1 km study site. Adults were stocked in the same locations we have used since 1993. We did not install a downstream weir prior to stocking adults; however, in both streams we put the adults upstream of a large beaver dam. We did not monitor spawning or count redds after the adults were stocked. I assumed that all females remained in the outplant section and spawned successfully.

Evaluation of Spawner Success

I used the weighted age-1 juvenile steelhead density abundance (fish/100 m^2), in strata 1 of Frenchman Creek and strata 2 of Beaver Creek, as an index of reproductive success. I assumed that all age-1 steelhead in Beaver and Frenchman creeks were the progeny of the previous years' hatchery adult outplants. I estimated the age-1 population in each stream and then estimated the number of smolts that could be produced from the age-1 population assuming a 50% over-winter mortality rate. I made two smolt estimates; first assuming all age-1 parr become smolts after one additional summer in freshwater (age-2+), and secondly assuming all age-1 parr become smolts after two additional summers in freshwater (age-3+). I estimated the mean number of smolts per female produced in Beaver and Frenchman creeks from the 1999 adult outplant and then projected what smolt-to-adult survival (SAR) is needed to return two adult spawners.

Snorkel procedures for fish densities and population totals

Each snorkel site consists of a single distinct habitat type (pool, pocket water, riffle, or run) and was chosen randomly throughout the stream. The number of snorkel sites of each habitat type was allocated proportional to the type's abundance in the stream strata. Depending on stream size, one to five snorkelers counted fish in each site. Each snorkel site was separated by at least one distinct habitat type change from a prior site. Snorkelers estimated the size of all fish except chinook salmon *O. tshawytscha* parr, dace *Rhinichthys sp.,* and sculpin *Cottus sp.* to the nearest inch. After the site was snorkeled, we measured the length and three to six widths of the site to calculate surface area.

Chinook salmon parr and steelhead parr were aged based on observed size. Chinook salmon parr were counted and classified as age-0 (<100 mm) or age-1 ($\geq$100 mm). Steelhead parr were classified as age-1, length 3 in to 5 in (76 mm to 127 mm); and age-2+, length >5 in (127 mm). Because steelhead fry (age-0, <75 mm) are indistinguishable from cutthroat trout *O. clarki* fry, we classified both as trout fry. We did not partition cutthroat trout, bull trout *Salvelinus confluentus*, brook trout *S. fontinalis*, or mountain whitefish *Prosopium williamsoni* into age

classes. Mean densities (fish/100 m^2) by habitat type in each stream strata were calculated for trout fry, the two age classes of steelhead and chinook salmon, resident trout, and mountain whitefish.

I calculated a weighted mean density (w_t) for each class of fish in each stream strata as:

$$W_t = \sum p_{it} d_{it} \quad (1)$$

where p_{it} = proportion of habitat *i* in stream strata *t*,
d_{it} = mean density of fish in habitat *i* in stream strata *t*,
i = pool, riffle, run, pocket water, and
t = stream strata.

I estimated the age-1 and age-2+ steelhead population and confidence intervals in Beaver and Frenchman creeks using the stratified sampling estimates of Scheaffer et al. (1986):

$$N_s = \sum_{i=1}^{4} A_i \bar{d}_i \quad (2)$$

where N_s = population total for strata *s*,
A_{it} = total surface area, in strata *t*, of habitat type *i*,
d_{it} = mean steelhead density, in strata *t*, of habitat *i*, and
i = pool, riffle, run, pocket water.

The total surface area (A_{it}) of each habitat type in stream strata *t* was calculated as:

$$A_i = L_s p_i w_i \quad (3)$$

where L_t = length of stream strata *t*,
p_{it} = proportion of habitat *i* in stream strata *t*, and
w_{it} = mean width of habitat *i* in strata *t*.

An approximate 95% confidence interval (CI_s) on the population estimates in the stream strata was calculated as:

$$CI_s = 2\sqrt{\sum_{i=1}^{h} A_i^2 \left(\frac{A_i - a_i}{A_i} \right) \left(\frac{s_i^2}{n_i} \right)} \quad (4)$$

where A_i = total surface area of habitat *i*,
s^2_i = the sample variance of mean steelhead density in habitat *i*,
a_i = total surface area of habitat *i* snorkeled in the strata,
n_i = number of habitat *i* sites snorkeled in the strata, and
i = pool, run, pocket water, or riffle habitat.

I treated A_i and a_i as constants when calculating the CI and assumed that the variance was due to differences of densities in each snorkel site, not area measurements. The estimated total abundance of each age class for the entire stream was found by summing the estimates of all strata.

Objective 2

This objective was designed to assess the juvenile production of returning adults that were stocked as fingerlings or smolts. We wanted to determine what life-stage of release would be best for supplementation by comparing the juvenile production of returning adults using age-1 parr abundance as the evaluation point. We used the Dworshak hatchery stock that were reared at Clearwater Hatchery for this study. We stocked fingerlings in the SF Red River yearly from 1993 to 1996 and smolts in Red River yearly from 1996 to 1999 (Byrne 2001). Personnel from IDFG operated the weir at the Red River satellite facility beginning April 1, 2000 to trap any returning steelhead. Adults were scanned for a coded-wire tag (CWT) or PIT tag and were inspected for fin clips to determine if the fish was released as a fingerling or smolt for this study before release upstream of the weir.

A steelhead supplementation crew snorkeled the SF Red River from its mouth upstream to the WF SF Red River to assess juvenile steelhead densities, using the procedures outlined in the Objective 1 Methods section.

The Red River fish densities, upstream of the SF Red River to Shissler Creek, were obtained from nine stream transects that are snorkeled yearly by IDFG Clearwater Region crews. There may be several habitat types within each transect. The Red River juvenile steelhead densities were calculated as the average density of the nine snorkel transects.

Objective 3

Adult Steelhead Weir in Fish Creek

We installed a temporary weir March 5 to March 8 and closed it on March 15. Adults enter a holding box that is checked throughout the day. When adult steelhead were present, we removed them with a net and placed them in a 100 gallon plastic water trough. We determined the sex, measured fork length to the nearest cm, collected scales, snipped a small portion of the anal fin for future DNA analysis, and used a paper punch to mark the right opercule before release upstream of the weir. We did not anesthetize the fish. Kelts were collected and checked for a right opercule punch, sexed, and measured for length. If the kelt was alive, we punched the left opercule and passed it downstream of the weir. We recorded the stream conductivity, TDS, pH, and the river level at the U.S. Forest Service (USFS) gauge located near the mouth of Fish Creek daily. The weir was opened on June 23, 2000 and removed during the next two days.

We discovered several openings at the bottom of the weir that were large enough for adults to pass through. These openings were closed as soon as we found them; however, some adults may have passed the weir unhandled. I used the total number of kelts recovered as catch, the number of adults trapped and marked at the weir and passed upstream as marks, and the number of marked kelts recovered as recaptures to obtain a maximum likelihood estimate and 95% CI of adult escapement.

Juvenile Fish Densities

Steelhead supplementation snorkeling is done to: (1) evaluate the success of hatchery outplants done for Objective 1 and 2 experiments in Beaver Creek, Frenchman Creek, and the

SF Red River and (2) to monitor steelhead densities in wild production streams. We use the same snorkel procedures that were outlined in the Objective 1 methods section on wild production streams we monitor. During the summer of 2000, we snorkeled Gedney, WF Gedney, and O'Hara creeks in the Selway River drainage and Canyon, Deadman, Fish, Bald Mountain, Boulder, Weir, Post Office, and Lake creeks in the Lochsa River drainage.

PIT Tagging

This project operates a screw trap in Fish Creek and coordinates steelhead tagging at screw traps used in the chinook supplementation study. In addition to Fish Creek, steelhead were tagged at eight screw traps operated by IDFG, three traps operated by the Nez Perce Tribe, one trap operated by the Shoshone-Bannock Tribe, and one trap operated by the US Fish and Wildlife Service. The screw traps in Clear Creek, Marsh Creek, and WF Yankee Fork were only fished during the spring. At most of the other sites, we fished the screw traps continuously from early March until ice-up in November, river conditions permitting. The traps were checked daily and the number of steelhead captured and tagged was recorded. Each fish was scanned before tagging to verify that it had not been tagged previously. We tagged steelhead >80 mm and measured fork length to the nearest mm and weight to the nearest 0.1 g.

In addition to the screw traps, we PIT tagged wild steelhead that SSS crews collected fly-fishing in Fish, Boulder, Deadman, Gedney, and O'Hara creeks during the summer. We fished Fish Creek on June 26 and again on July 15 and July 16. We fished Gedney Creek on July 30 and again on August 26 and August 27. I combined the two fishing occasions in Fish and Gedney creeks for the data analysis. Steve Achord, from the National Marine Fisheries Service, collected and tagged juvenile steelhead during his summer tagging of chinook salmon parr in Bear Valley Creek, Elk Creek, Herd Creek, Secesh River, and Valley Creek.

I calculated the mean steelhead length, weight, and condition factor at each screw trap site for the spring (start of trapping to May 31), summer (June 1 to August 31), and fall (September 1 to end of trapping) periods. I calculated the mean length, weight, and condition factor of steelhead collected in streams by fly-fishing and electrofishing. At all sites, the PIT-tagged fish were grouped into 5 mm length classes (class 70 = fish 70-74 mm, class 75 = fish 75-79 mm, etc.) and the length frequency was plotted. Box plots displaying the median length, 95% CI of the median length, and the 25% to 75% percentiles of length were plotted for each release site. I did an ANOVA on steelhead length that were captured in screw traps at Crooked Fork Creek, Fish Creek, Johnson Creek, Pahsimeroi River, and Secesh River. All other trap sites had <400 steelhead tagged during the year and were omitted from the length analysis.

I determined the date that 10%, 25%, 50%, 75%, 90% fish were tagged at the Crooked Fork Creek, Fish Creek, Red River, Johnson Creek, Pahsimeroi River, Lower SF Salmon River, White Sands Creek, and Secesh River screw traps and plotted the yearly date quantiles for each site. At the other screw traps, less than 100 steelhead were caught or the trap was only fished during the spring.

Juvenile steelhead migration estimate in Fish Creek

We released PIT-tagged steelhead about 600 m upstream of the screw trap and recorded the number of recaptures at the trap daily to estimate trap efficiency and the number of migrants. All recaptures were released downstream of the trap. On days when more than 50

steelhead were tagged, we released 50 fish upstream of the trap and the remainder downstream of the trap. On days when less than 50 steelhead were tagged, we released all newly tagged fish upstream of the trap. Based on flow and time of year, I split the trapping season into periods and determined the number of steelhead trapped, fish released upstream (marks), and recaptured fish. I used a maximum likelihood estimator (Wu and Steinhorst 2000) to estimate the number of migrants and a 95% CI that left the stream during each period and throughout the entire trapping season.

Growth

The growth rate of individual juvenile steelhead was calculated from fish we PIT tagged in Fish, Gedney, Storm, and White Sands creeks that were recaptured in 2000. I put the recaptured fish into two groups: (1) fish that were tagged and recaptured in 2000, and (2) fish that were tagged in 1999 and recaptured in 2000. We did not recapture any fish this year that were tagged in 1998 or earlier. I omitted the fish from the analysis if it was recaptured $\leq$30 days after tagging. I calculated the growth rate (G) of a fish as:

$$G = \frac{L_2 - L_1}{D} \tag{5}$$

where L_1 = length at first capture,
L_2 = length at second capture and,
D = number of days between the two captures.

I calculated the mean growth rate and 95% CI in Fish, Gedney, Storm, and White Sands creeks for each group. Storm Creek is a tributary of White Sands Creek. I did a t-test to determine if there was a significant difference in growth rate between Storm Creek and White Sands Creek. If there was not a difference, I combined the data of Storm and White Sands creeks to do an ANOVA to test for differences in growth rate among the streams for steelhead that were tagged in 1999. I did a regression analysis on each recapture group to determine the relation between growth rate and length at first capture. I did a regression analysis on the two recapture groups from Fish Creek to determine the relation between growth rate and temperature units accrued between tagging and recapture.

Smolt Detections

I obtained the date and dam of detection, date of tagging, and the length and weight at tagging of all wild steelhead smolts that were detected at Lower Granite, Little Goose, Lower Monumental, McNary, John Day, and Bonneville dams from SSS tagging sites from the PTAGIS database on December 4, 2000. For each release site I calculated the number of smolt detections from steelhead that were tagged in 2000; August 15, 1999 to December 15, 1999; June 1, 1999 to August 14, 1999; fish tagged in 1999 before June 1; and fish tagged in 1998 and earlier. For each tag period I determined the total number of steelhead juveniles tagged and the number of steelhead juveniles $\geq$125 mm that were tagged and calculated the percent of tagged fish that were detected.

I calculated the mean length at the time of tagging of smolts from each stream that were tagged and detected in 2000 and fish that were tagged the previous fall after August 14, 1999. I did an ANOVA on smolt length and used Tukey HSD multiple comparison to compare all stream

pairwise smolt lengths. I included steelhead from nine streams (n $\geq$45 for each stream) in the ANOVA of smolt length: Crooked Fork Creek, Clear Creek, Fish Creek, Gedney Creek, Johnson Creek, Lick Creek, Lower SF Salmon River, Pahsimeroi River, and White Sands Creek. I plotted the length frequency and box plots of the median length and the 25% to 75% percentile of length of smolts from each stream.

I determined the date that 10%, 25%, 50%, 75%, and 90% of the total number smolt detections at Lower Granite Dam (LGR) were attained from SSS release sites. I determined the median travel time (and 90% CI) from release site to LGR of fish that were tagged and detected in 2000. Travel time was calculated as kilometers traveled per day from release site to detection at LGR. Smolts from Clear Creek were excluded from the travel time analysis because fish were often held several days at the trap site before release, whereas fish were tagged and released daily at all other sites.

Steelhead Scale Samples

We collected scales of adult steelhead from Fish Creek and Rapid River. Scales of juvenile steelhead were obtained from fish in Crooked Fork Creek, White Sands Creek, Fish Creek, SF Salmon River, and Pahsimeroi River. We measured the fork length of each fish we collected scales from. Scales were taken from both sides of the fish from the preferred area (MacLellan 1987). This area is located just above the lateral line, posterior of a vertical line drawn from the posterior end of the dorsal fin. The scales were mounted in acetate and will be aged in the future.

Juvenile steelhead DNA sampling

We received new funding from BPA in 2000 to determine the evolutionary significance and genetic population structure of Idaho's steelhead assemblage. The total genomic DNA will be extracted and used for PCR amplification of 10 microsatellite genetic markers. Dr. Jennifer Nielsen at the Alaska Biological Science Center, Anchorage will do the genetic analysis as a subcontractor to IDFG.

The hypotheses to be tested are:

HO1 — Unique evolutionary and biogeographic structure occurs in natural populations of steelhead in Idaho. Steelhead tissues collected from Idaho for this study contain distinct genetic allelic structure when compared to other coastal and interior steelhead populations. Tests of this hypothesis could be used to look at genetic substructure within and between river basins in comparison with sample collections from other parts of the distribution of *O. mykiss* throughout their range.

HO2 — Introgression by straying hatchery-produced steelhead has had no major effect on the natural genetic diversity found in Idaho steelhead. Hatchery fish used for supplementation in the same geographic area may carry diminished genetic diversity due to bottleneck effects induced through common husbandry practices.

Idaho Department of Fish and Game personnel sampled 70 wild steelhead streams in the Salmon and Clearwater drainages and collected 50 to 70 juvenile steelhead fin samples

from each stream. We also collected fin samples from suspected residual steelhead populations in Collins Creek (North Fork [NF] Clearwater drainage), Little Weiser River, upper Middle Fork (MF) Payette River, and Big Smoky Creek (Boise River drainage), streams that historically were accessible to steelhead but are presently blocked by dams. Fish were collected from several locations to avoid sampling from the same family. We collected the fish from a two to four kilometer length of stream where possible. We collected fin samples from steelhead juveniles age-1 and older (fish >90 mm). We did not take samples from this year's fry. In most streams, fish were collected fly-fishing in July and August. We snipped a small portion of the anal or caudal fin and stored it in pure 95% ethanol. Fish were released after sampling. We collected fin samples from migrating steelhead captured in screw traps in the Lemhi and Pahsimeroi rivers to minimize the presence of resident rainbow trout in those samples. We also collected fin samples from the five hatchery steelhead stocks raised in Idaho: Dworshak, Oxbow, Sawtooth, Pahsimeroi, and East Fork (EF) Salmon B (derived from Dworshak stock).

Stream Temperature

I recorded stream temperature in tributaries throughout the Clearwater River and Salmon River drainages with HOBO™ temperature recorders. The water temperature was recorded every 0.5 h to 1.6 h from early spring until late October. The recorders were reset to measure stream temperature every 0.5 h to 2.5 h, depending on location and access, throughout the winter. The daily mean, maximum, and minimum temperatures were calculated for each stream.

Other fish species in Fish Creek

We collected data at the Fish Creek screw trap on cutthroat trout, bull trout, longnose dace, speckled dace, and chinook salmon. The number of dace, chinook salmon parr, cutthroat trout, and bull trout trapped daily was recorded. We PIT tagged all bull trout and chinook parr and up to five cutthroat trout each day. All chinook parr, cutthroat trout, and bull trout were measured to the nearest mm and weighted to the nearest 0.1 g. All dace were counted and a subsample was measured and weighed daily. Data for chinook parr, cutthroat trout, and bull trout was analyzed in a similar manner as juvenile steelhead.

RESULTS

Objective 1

Collecting and Outplanting Adult Steelhead

Sawtooth Fish Hatchery personnel stocked Beaver and Frenchman creeks on April 13, 2000 with 15 males and 15 females in each stream. The mean length of males and females stocked in Beaver Creek was 61 cm (± 2 cm) and 58 cm (± 2 cm), respectively. The mean length of males and females stocked in Frenchman Creek was 60 cm (± 2 cm) and 58 cm (± 1 cm).

Evaluation of Spawner Success

Crews snorkeled Frenchman and Beaver creeks from August 16 to August 18. Snorkel conditions were excellent and the water temperature ranged from 11°C to 14°C. The weighted mean age-1 steelhead densities were 5.53 fish/100 m^2 and 3.89 fish/100 m^2 in Beaver and Frenchman, respectively. The weighted mean age-2+ juvenile steelhead densities were 1.17 fish/100 m^2 and 0.54 fish/100 m^2 in Beaver and Frenchman creeks, respectively (Figure 1).

The estimated age-1 population was 567 (95% CI, ± 217) and 352 (95% CI, ± 140) fish in Beaver and Frenchman creeks, respectively. Assuming a 50% over-winter mortality rate, I estimated that 9.5 age-2+ smolts or 4.7 age-3+ smolts per female could be produced in Beaver Creek from the adults that were stocked in 1999. In Frenchman Creek, the estimated smolt production per female was 8.8 age-2+ smolts or 4.4 age-3+ smolts from adults stocked in 1999. The SAR needed to return two adults to Beaver and Frenchman creeks from the 1999 adult outplant exceeds 21% if all fish become smolts at age-2+ (Table 1).

Objective 2

There were no smolt detections from any hatchery fingerling or smolt release groups in 2000. The Red River weir was intact all spring, but we did not trap any adult steelhead. We snorkeled the SF Red River on July 6 and 7. The age-1 and age-2+ steelhead densities were 0.74 fish/100 m^2 and 0.76 fish/100 m^2, respectively. The age-1 and age-2+ densities in Red River, upstream of the SF Red River were 0.06 fish/100 m^2 and 0.08 fish/100 m^2, respectively (Figure 2).

There were 11 adult steelhead detected at Lower Granite Dam (LGR) between September 21, 2000 and October 19, 2000 that were released as smolts (Table 2). These fish should return to Red River and spawn in the spring 2001.

Objective 3

Adult Steelhead Weir in Fish Creek

The total adult escapement was 15 females and 11 males based on fish trapped and unmarked kelts recovered. We trapped and passed upstream nine males and 14 females at the weir. The mark-recapture estimate of the adult escapement was 29 adults, and the upper 95% CI was 58. The lower 95% CI of the escapement was less than the number of adults we handled. This was the second lowest escapement estimate since we began operating a weir in 1992 (Figure 3 and Appendix 1).

The first adult was trapped on April 1, 2000 and the last on May 21, 2000. The median arrival date was April 20, 2000 and May 1, 2000 for females and males, respectively (Figure 4). The mean length of males was 73 cm (n = 11, 95% CI $\pm$ 7 cm), and the mean female adult length was 79 cm (n = 15, 95% CI $\pm$ 3 cm). Both the largest (89 cm) and smallest (61 cm) adult we trapped were males (Figure 5). There was not a significant difference in length between males and females (t-test, t = 1.888, p = 0.07). We caught 13 kelts (7 males and 6 females), the first on April 21, 2000 and the last on June 22, 2000 (Figure 6). Three of the kelts were unmarked. Five of the seven female kelts and three of the six male kelts were alive when recovered.

Juvenile fish densities

We began our snorkel surveys on July 5 and completed them on August 25. The age-1 and age-2+ steelhead densities were highest in pool and run habitat and lowest in riffle habitat. The densities in pocket water habitat were intermediate. Age-1 and age-2+ steelhead densities were less than 10 fish/100 m^2 in nearly every habitat type in each stream we snorkeled (Table 3).

The weighted mean stream age-1 steelhead densities ranged from 11.49 fish/100 m^2 in the WF Gedney Creek to 0.16 fish/100 m^2 in strata 2 of the SF Red River. Steelhead age-2+ weighted densities ranged from 6.9 fish/100 m^2 in the WF Gedney Creek to 0.24 fish/100 m^2 in strata 2 of the SF Red River (Table 4). The combined age-1 and age-2+ steelhead densities rose in Fish, Deadman, and Post Office and declined in WF Gedney, Gedney, Canyon, and Weir creeks from levels observed in 1999 (Figures 7 and 8). The largest increase compared to 1999 densities (in non-supplemented streams) was 97% in Post Office Creek (from 2.29 to 4.51 fish/100 m^2) and the largest decline was –53% in Weir Creek (from 8.48 to 3.96 fish/100 m^2).

PIT tagging

We tagged 2,849 juvenile steelhead at the nine Salmon River screw traps and 7,079 juvenile steelhead at the five Clearwater River screw traps in 2000 (Tables 5 and 6). The number of steelhead tagged at each site varied from 5,851 at Fish Creek to 32 at Marsh Creek. The mean length of steelhead tagged during the year ranged from 181 mm at Marsh Creek to 104 mm at Red River. In the Clearwater River drainage, the length frequency distribution was skewed to the smaller length classes in all streams except Red River, where it was skewed to the larger length classes (Figures 9 and 10). In the Salmon River drainage, the length frequency distribution was skewed to the smaller length classes in Johnson Creek and the Sawtooth trap, skewed to the larger length classes in Lake Creek, Pahsimeroi River, and the

Secesh River, and not skewed in Lower SF Salmon River, Marsh Creek, SF Salmon River at Knox Bridge, and WF Yankee Fork (Figures 11 and 12).

Ninety percent of the total number of steelhead were tagged at five trap sites: Fish Creek (n = 5,851, 59%), Johnson Creek (n = 1,140, 12%), Pahsimeroi River (n = 820, 8%), Crooked Fork Creek (n = 690, 7%), and the Secesh River (n = 411, 4%). There was a significant difference in fork length of the steelhead tagged among these five streams (ANOVA, $F = 329.4$, $p < 0.001$) and all stream pairwise comparisons were significant (Tukey's HSD, $p < 0.002$ for all comparisons). The largest steelhead, in descending order, were tagged in Johnson Creek, Crooked Fork Creek, Pahsimeroi River, Fish Creek, and Secesh River.

We tagged 2,611 juvenile steelhead that were collected fly-fishing, 511 juvenile steelhead collected electrofishing, and 114 that were captured in minnow traps this year (Table 7). Steelhead that were collected fly-fishing were larger than those collected electrofishing. The fish collected electrofishing were skewed to the length classes $\leq$125mm in three of the five streams, whereas the fly-caught fish were distributed over a wider range of length classes (Figure 13 to 16)

The median date of steelhead tagged, at screw traps, ranged from May 2 at White Sands Creek to September 12 at Fish Creek (Table 8). The migration pattern at Fish Creek differed from the other trap sites. The middle migration, when the 25% to 75% percentile of fish were tagged, occurred during a nine day period from September 2 to September 11. The middle migration occurred during a 38 day period in Johnson Creek from July 27 to September 3, a 61 day period in SF Salmon River from July 6 to September 5, and a 75 day period in Crooked Fork Creek from June 22 to September 5. At the Pahsimeroi River and White Sands Creek the middle migration took 180 days and 172 days, respectively (Figure 17).

Juvenile Steelhead Migration Estimate in Fish Creek

I determined the number of steelhead that were trapped, marked, and recaptured during 13 trapping periods this year (Table 9). At the beginning of the trapping season until May 20, I defined two periods: March 16 to April 3 and April 4 to May 20. These periods were based on flow and our ability to fish the screw trap. When the flow exceeded 3.0 feet at the USFS gauge, we had to move the trap out of the thalweg and close to shore. A back eddy develops in the stream at the trap site when the flow is >3.5 and the trap must be fished close to shore. When flow is less than 3.0 feet, we are able to keep the screw trap in the thalweg. From March 16 to April 3 flow ranged from 2.7 to 3.5 feet. Flow exceeded 3.5 feet on April 3 and remained above 3.0 feet until May 22. After May 22 the flow dropped steadily until rainstorms began in September (Figure 18). Beginning May 21, the trapping periods were approximately two weeks long until trapping ended on November 11. There was a one-day surge in flow on October 1 from a heavy rainfall that caused us to move the trap close to shore; hence, I made an estimate for that day only.

I estimated that 24,663 juvenile steelhead (95% lower CI = 21,476 and 95% upper CI = 32,373) migrated past the Fish Creek screw trap in 2000. Nearly half of the migrants left during a two week period from August 29 to September 11 (Table 9 and Figure 18), and 16,773 of the migrants (68%) left the stream between August 15 and November 11. This years' migration estimate was nearly equal to the 1999 migration estimate, and the number of migrants that left the stream during the fall was the second largest since trapping began (Figure 19).

Growth

The mean growth rate (mm/day) of juvenile steelhead that were tagged and recaptured in Fish Creek in 2000 was 0.1818 mm/day (95% CI, ± 0.01357). The mean growth rate of juvenile steelhead that were tagged in 1999 and spent one winter in the stream was: 0.11706 mm/day (95% CI, ± 0.01789) in Fish Creek, 0.10522 mm/day (95% CI, ± 0.01686) in Gedney Creek, 0.07853 (95% CI, ± 0.01077) in Storm Creek, and 0.06740 (95% CI, ± 0.01562) in White Sands Creek (Table 10).

There was not a significant difference in growth rate between White Sands Creek and Storm Creek (t-test, $t = 1.037$, $p = 0.305$); hence, I combined the data from Storm Creek with White Sands Creek (Storm Creek is a tributary of White Sands Creek) to compare the one winter growth rate with Fish and Gedney creeks. There was a significant difference in growth rate among the three drainages (ANOVA, $F = 11.374$, $p < 0.001$). Tukey's pairwise comparison test revealed that there was a significant difference in steelhead growth rate between Gedney and White Sands ($p = 0.007$) and between Fish and White Sands ($p < 0.001$). There was not a significant difference in the growth rate of steelhead in Fish and Gedney creeks ($p = 0.499$).

There was a significant negative relation between growth rate and length at first capture in Fish Creek (Figure 20, top graphs) of steelhead that were tagged in 2000 ($n = 138$, $F = 8.643$, $p = 0.004$), but the relation (although negative) was not significant for steelhead that were tagged in 1999 ($n = 36$, $F = 2.259$, $p = 0.142$). There was a significant negative relation between growth rate and length at first capture for steelhead that were tagged in 1999 and recaptured in 2000 (Figure 20, bottom graphs) in Gedney Creek ($n = 30$, $F = 59.01$, $p < 0.001$) and the White Sands drainage ($n = 53$, $F = 5.406$, $p = 0.027$).

The positive relation between temperature units (TU) and growth rate in Fish Creek (Figure 21) was not significant for steelhead that were tagged in 2000 ($n = 138$, $F = 0.004$, $p = 0.948$) or those tagged in 1999 ($n = 36$, $F = 3.963$, $p = 0.054$).

Smolt Detections

There were 5,442 steelhead smolts detected during MY 2000 that were tagged at SSS sites. Eighty percent (4,247) of the detected smolts were tagged in Fish Creek (Table 11). The mean smolt length at time of tagging ranged from 145 mm in O'Hara Creek to 193 mm from the Pahsimeroi River (Table 12, Figures 22 to 24). There was a significant difference in smolt length (ANOVA, $F = 126.38$, $p < 0.001$) among the nine streams that had ≥45 detections. Ten of the 36 stream pairwise comparisons of smolt length were not significant (Table 13).

The median smolt arrival date at Lower Granite Dam (LGR) ranged from April 17 from Crooked Fork Creek to May 7 from Marsh Creek (Table 14). Smolts from the Clearwater River drainage tended to arrive earlier and migrated past LGR during a shorter period of time than smolts from the Salmon River drainage (Figure 25).

The median travel time of smolts tagged in 2000 to LGR ranged from 10.6 km/day from Fish Creek to 69 km/day from the Pahsimeroi River (Table 15 and Figure 26). There was a significant positive relation between smolt travel time and distance to LGR (Figure 27).

Steelhead Scale Samples

We collected scales from 23 adult steelhead in Fish Creek and 17 adult steelhead Rapid River. Juvenile scales were collected from fish that were caught in screw traps or minnow traps from the start of trapping in March until June 1 in Fish Creek (n = 231), Crooked Fork Creek (n = 106), and White Sands Creek (n = 65). We also collected scales after August 15 from steelhead caught in screw traps in Fish Creek (n = 362), Crooked Fork Creek (n = 145), White Sands Creek (n = 340, and the Pahsimeroi River (n = 185). We collected scales from 170 steelhead in the SF Salmon River from April 1 to October 20. We mounted all the scales in acetate but have not aged them yet.

Juvenile steelhead DNA sampling

All juvenile steelhead fin tissues we collected for the DNA analysis (Table 16) were shipped to Dr. Jennifer Nielsen at the Alaska Biological Science Center, Anchorage in November 2000. The analysis of the samples should be completed in 2001.

Stream Temperature

The daily mean, maximum, and minimum temperature of the streams we recorded temperature (Table 17) has been calculated and entered into an IDFG database at the Nampa Research Center. The temperature data is available upon request. A plot of the yearly stream temperature from Fish Creek is in Figure 28.

Other fish species in Fish Creek

In addition to steelhead juveniles, we trapped 377 chinook salmon parr, 491 cutthroat trout, 16 bull trout, 1,381 longnose dace, 552 shortnose dace, and 1,008 dace that were not identified to species at the Fish Creek screw trap (Table 18). A subsample of all fish except the dace were PIT tagged. Dace, cutthroat trout, and bull trout migrants left the stream earlier than the steelhead or chinook parr. Most of the chinook migrated after September 16 and had the latest median migration date of the five species (Figure 29).

We recaptured 18 cutthroat trout that were tagged at the screw trap in 1998 or 1999. The mean growth rate was 0.20904 mm/day (95% CI, $\pm$ 0.03376). There was a significant negative relation between cutthroat growth rate and length at first capture (Figure 30).

SUMMARY

Two ongoing experiments are assessing the use of hatchery stocks for supplementation in streams where the original stock has been expirated. We have stocked Sawtooth Hatchery adults and estimated potential smolt production since 1993 in the upper Salmon River tributaries of Beaver and Frenchman creeks. Age-1 parr densities have increased after the adult outplants, and the estimated number of smolts per female has ranged from about 3 to 31 and averaged 14.6 in Beaver Creek and 7.7 in Frenchman Creek, if all fish smolt at age-2+. At this level of smolt production, SARs must range from about 6.5% to 72% and average 13.7% in Beaver Creek and 26% in Frenchman Creek to return two adults. It is doubtful that all fish smolt at age-2+, and the additional freshwater mortality could double the SARs needed to return two adults.

The second experiment assesses which life-stage of release is best for supplementation and is being done in the Red River drainage with the Dworshak Hatchery stock. Hatchery fingerling and smolts were stocked previously and we are waiting for adults to return. To date, one adult has returned from the smolt stockings and none from the fingerling stockings. However, in 2001 we expect adult returns from the smolt stocking. Eleven adults were detected at LGR during the fall 2000. If these fish survive the winter, they should return to Red River to spawn in the spring 2001. I planned this experiment to return at least 10 spawning females per release group. Although we should get some adult returns from the smolt outplant next spring, there may not be enough spawners to document a change in juvenile parr production in the stream.

During 2000, as we have done in the past, most of our effort was estimating juvenile steelhead abundance with snorkel surveys in Lochsa and Selway River tributaries, coordinating steelhead PIT tagging at chinook supplementation screw traps, and our intensive monitoring of the Fish Creek steelhead population. Steelhead parr abundances in 2000 remained near the levels we have observed since 1996 (Figures 7 and 8) suggesting a relatively constant, albeit depressed number of adult spawners. However, age-1 parr abundance is expected to decline in Fish Creek in 2001. The adult escapement in Fish Creek this year was the lowest we have recorded since 1992, with the exception of 1997 (Appendix 1).

We collected all samples for our new task to document the genetic stock structure of Idaho's wild steelhead population during the summer 2000. The DNA analysis is in progress and should be completed in 2001.

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Table 1. The number of smolts that could be produced from the adult outplants in Beaver and Frenchman creeks using the estimated age-1 population and the smolt-to-adult survival (SAR) needed to return two adults to the stream. I assumed a 50% over-winter mortality rate to estimate the number of age-2+ and age-3+ smolts. Age-2+ smolts will rear in freshwater for another summer and two winters. Age-3+ smolts will rear in freshwater for two more summers and three winters.

Year stocked	Female spawners	Eggs deposited	Age-1 population	Age-1 95% CI	Survival to Age-1	Estimated smolts		Smolts per female		SAR	
						Age-2+	Age-3+	Age-2+	Age-3+	Age-2+	Age-3+
Beaver Creek											
1993[a]	6	23,124	1,134	± 282	4.90%	284	142	47.3	23.6	4.2%	8.5%
1993[b]	15	57,810	1,134	± 282	1.96%	284	142	18.9	9.5	10.6%	21.2%
1994	8	38,888	543	± 257	1.40%	136	68	17.0	8.5	11.8%	23.6%
1995	7	29,337	879	± 258	3.00%	220	110	31.4	15.7	6.4%	12.7%
1996	13	62,647	644	± 189	1.03%	161	81	12.4	6.2	16.1%	32.3%
1997	12	52,200	284	± 142	0.54%	71	36	5.9	3.0	33.8%	67.6%
1998	10	43,500	462	± 127	1.06%	116	58	11.6	5.8	17.3%	34.6%
1999	15	65,250	567	± 217	0.87%	142	71	9.5	4.7	21.2%	42.3%
2000	15										
					Mean (1994 to 1999):			14.6	7.3	13.7%	27.4%
Frenchman Creek											
1993	12	46,248	595	± 376	1.29%	149	74	12.4	6.2	16.1%	32.3%
1994[c]	10	48,610	274	± 146	0.56%	69	34	6.9	3.4	29.2%	58.4%
1994[d]	5	24,305	274	± 146	1.13%	69	34	13.7	6.9	14.6%	29.2%
1997	15	65,250	166	± 91	0.25%	42	21	2.8	1.4	72.3%	144.6%
1999	10	43,500	352	± 140	0.81%	88	44	8.8	4.4	22.7%	45.5%
2000	15										
			Mean (1993, 1994, 1997, and 1999)[c]					7.7	3.9	26.0%	51.9%
			Mean (1993, 1994, 1997, and 1999)[d]					9	5	21.2%	42.5%

[a] Assumes six females spawned.
[b] Assumes 15 females spawned.
[c] Assumes all females spawned in 1994.
[d] Assumes that half of the potential total eggs were deposited before otter kills in 1994.

Table 2. Summary of the number of hatchery smolts stocked in Red River near Soda Creek, the number of smolts detected at dams on the Columbia and Snake rivers each smolt migration year (MY), the number of adults detected at Lower Granite Dam (LGR), and the survival rate from detected smolt to detected adult (SAR). There were no smolt detections from these release groups in 2000. All adult detections in 2000 occurred between September 21 and October 19.

Release Year	Number stocked	Number PIT-tagged	Smolts detected at dams during MY					Adults detected at LGR				SAR
			1996	1997	1998	1999	Total	1997	1998	1999	2000	
1996	8,000	3,999	1,391	2	0	0	1,393	0	1	0	0	0.07%
1997	4,983	4,983	-	1,948	19	0	1,967	-	0	0	0	0.00%
1998	4,497	4,497	-	-	1,862	5	1,867	-	-	0	8	0.43%
1999	5,003	5,003	-	-	-	1,401	1,401	-	-	-	3	0.21%

Table 3. Mean fish densities (fish/100 m^2) by habitat type in streams that were snorkeled during the summer 2000. Area = total area snorkeled (m^2), N = number of sites snorkeled; Trout fry = all trout (except brook trout) ≤75 mm; SH 1 = juvenile steelhead 76 mm to 127 mm; SH 2+ = juvenile steelhead >127 mm; CH 0 = age-0 chinook salmon; CH 1 = age-1 chinook salmon; Cutt = all cutthroat trout; Bull = all bull trout; Brook fry = all brook trout <75 mm; Brook = all brook trout ≥75 mm; White = all mountain whitefish; Total = total salmonid density. PL = pool, PW = pocket water, RI = riffle, and RU = run.

Stream	Date	Habitat type	Strata	Area	N	Trout Fry	Steelhead parr Age-1	Steelhead parr Age-2+	Chinook Age-0	Chinook Age-1	Cutt	Bull	Brook Fry	Brook Parr	White	Total
Clearwater River drainage																
Bald Mountain Creek	8/14	PL	1	137	5	0.00	7.71	8.75	0.00	0.00	10.69	2.72	0.00	0.00	0.00	29.87
Bald Mountain Creek		PW	1	1,715	16	1.58	4.16	1.74	0.00	0.00	4.24	0.00	0.00	0.00	0.00	11.72
Bald Mountain Creek		RU	1	51	1	1.96	9.80	3.92	0.00	0.00	3.92	0.00	0.00	0.00	0.00	19.61
Boulder Creek	8/24	PL	1	618	6	0.00	12.88	8.51	0.61	0.20	6.51	0.20	0.00	0.18	0.00	29.09
Boulder Creek	and	PW	1	5,229	23	0.70	4.64	3.23	0.02	0.00	0.58	0.03	0.00	0.00	0.00	9.20
Boulder Creek	8/25	RU	1	772	6	0.96	3.28	5.34	0.15	0.00	1.87	0.00	0.00	0.15	0.00	11.74
Canyon Creek	8/12	PL	1	158	5	2.36	5.46	11.67	0.00	0.00	3.77	0.00	0.00	0.00	0.00	23.26
Canyon Creek		PW	1	1,049	12	2.15	3.26	1.85	0.00	0.00	0.23	0.00	0.00	0.00	0.00	7.49
Canyon Creek		RI	1	115	2	5.87	2.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.47
Canyon Creek		RU	1	270	5	4.55	4.32	3.00	0.00	0.00	1.41	0.00	0.00	0.00	0.00	13.29
Deadman Creek	8/12	PL	1	79	2	15.76	20.24	4.84	0.00	0.00	1.33	0.00	0.00	0.00	0.00	42.17
Deadman Creek		PW	1	1,510	11	14.27	4.58	0.56	0.06	0.00	0.41	0.00	0.00	0.00	0.00	19.87
Deadman Creek		RI	1	315	3	15.99	3.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.06
Deadman Creek		RU	1	439	6	24.66	7.98	2.26	0.19	0.00	0.49	0.00	0.00	0.00	0.00	35.57
Fish Creek	7/13	PL	1	1,231	8	1.60	12.22	10.03	0.30	0.00	2.45	0.00	0.00	0.00	0.00	26.60
Fish Creek	to	PW	1	10,018	22	0.84	6.08	4.07	0.54	0.01	0.78	0.00	0.00	0.00	0.00	12.33
Fish Creek	7/18	RI	1	2,096	5	0.70	4.23	3.53	0.41	0.00	0.95	0.00	0.00	0.00	0.00	9.81
Fish Creek		RU	1	4,278	17	1.36	9.78	7.20	0.68	0.00	1.11	0.00	0.00	0.00	0.01	20.15
Gedney Creek	7/27	PL	1	942	6	6.66	7.80	10.08	0.00	0.20	0.53	0.15	0.00	0.00	0.78	26.19
Gedney Creek	to	PW	1	8,079	24	7.30	5.28	3.44	0.29	0.01	0.07	0.00	0.00	0.00	0.32	16.70
Gedney Creek	8/1	RI	1	1,977	6	9.12	4.75	1.50	0.05	0.00	0.00	0.00	0.00	0.00	0.33	15.75
Gedney Creek		RU	1	2,157	11	10.08	6.07	5.95	0.39	0.05	0.53	0.20	0.00	0.00	0.22	23.49
Gedney Creek	7/28	PL	2	196	3	2.92	17.05	7.03	0.00	0.00	0.49	0.00	0.00	0.00	0.00	27.49
Gedney Creek	and	PW	2	1,159	9	2.57	6.97	2.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.08
Gedney Creek	7/29	RI	2	179	2	2.19	6.07	1.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.43
Gedney Creek		RU	2	206	3	1.37	11.52	5.69	0.00	0.00	0.47	0.00	0.00	0.00	0.00	19.04

Table 3 (Continued.)

Stream	Date	Habitat type	Strata	Area	N	Trout Fry	Steelhead parr Age-1	Steelhead parr Age-2+	Chinook Age-0	Chinook Age-1	Cutt	Bull	Brook Fry	Brook Parr	White	Total
WF Gedney Creek	7/28	PL	1	388	3	0.66	14.89	13.03	0.00	0.00	0.24	0.21	0.00	0.00	0.21	29.24
WF Gedney Creek	and	PW	1	1,677	7	5.37	9.17	3.65	0.08	0.00	0.12	0.06	0.00	0.00	0.06	18.49
WF Gedney Creek	7/29	RI	1	689	3	5.50	8.65	4.16	0.00	0.00	0.12	0.00	0.00	0.00	0.00	18.43
WF Gedney Creek		RU	1	659	4	10.62	15.35	10.43	0.14	0.00	0.82	0.00	0.00	0.11	0.21	37.69
Lake Creek	8/14	PL	1	636	5	0.82	4.24	4.44	0.00	0.00	1.51	0.14	0.00	0.00	0.00	11.15
Lake Creek		PW	1	2,299	9	0.43	1.17	0.88	0.00	0.00	0.06	0.04	0.00	0.00	0.00	2.58
Lake Creek		RI	1	476	1	1.47	0.42	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	2.10
Lake Creek		RU	1	1,181	6	0.25	1.72	0.88	0.00	0.00	0.60	0.00	0.00	0.00	0.00	3.45
O'Hara Creek	8/10	PL	1	152	2	8.18	9.78	4.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.14
O'Hara Creek	and	PW	1	1,887	11	2.65	8.61	1.22	0.05	0.00	0.00	0.00	0.00	0.00	0.04	12.57
O'Hara Creek	8/11	RI	1	488	2	4.36	5.17	0.59	1.02	0.00	0.00	0.00	0.00	0.00	0.00	11.14
O'Hara Creek		RU	1	736	5	6.47	8.38	1.61	0.90	0.00	0.41	0.00	0.00	0.00	0.10	17.87
Hanby Fork	8/11	PL	1	116	3	3.24	7.38	1.52	0.00	0.00	0.83	0.00	0.00	0.00	0.00	12.96
Hanby Fork		PW	1	512	4	3.02	2.75	0.41	0.00	0.00	0.24	0.00	0.00	0.00	0.00	6.42
Hanby Fork		RU	1	82	2	4.95	9.78	1.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.96
Post Office Creek	8/13	PL	1	123	4	23.99	9.09	6.00	0.00	0.00	0.74	0.00	0.00	0.00	0.00	39.83
Post Office Creek		PW	1	466	4	13.96	2.77	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.85
Post Office Creek		RI	1	552	8	14.98	2.23	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.54
Post Office Creek		RU	1	360	6	11.98	3.04	1.16	0.00	0.00	1.29	0.00	0.00	0.00	0.00	17.47
SF Red River	7/6	PL	1	186	4	0.00	0.50	3.74	0.00	0.00	8.98	0.00	0.00	0.00	0.00	13.22
SF Red River		PW	1	766	6	0.00	1.38	0.39	0.00	0.00	0.88	0.00	0.00	0.00	0.26	2.90
SF Red River		RI	1	1,146	10	0.07	1.26	0.95	0.00	0.00	2.19	0.00	0.00	0.00	0.16	4.64
SF Red River		RU	1	990	10	0.29	1.85	1.82	0.00	0.10	5.65	0.00	0.00	0.00	0.12	9.82
SF Red River	7/6	PL	2	186	6	0.00	0.85	0.00	0.00	0.00	15.88	0.00	0.00	0.00	0.00	16.73
SF Red River	and	PW	2	637	6	0.43	0.00	0.52	0.00	0.00	0.45	0.00	0.00	0.11	0.00	1.51
SF Red River	7/7	RI	2	907	11	0.00	0.00	0.14	0.00	0.00	1.92	0.00	0.00	0.11	0.00	2.17
SF Red River		RU	2	1,184	14	0.00	0.17	0.28	0.00	0.00	1.67	0.06	0.00	0.40	0.00	2.59
WF SF Red River	7/7	PL	1	59	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WF SF Red River		RI	1	264	5	0.00	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.34
WF SF Red River		RU	1	90	2	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00	0.00	0.00	0.97

Table 3 (Continued.)

Stream	Date	Habitat type	Strata	Area	N	Trout Fry	Steelhead parr Age-1	Steelhead parr Age-2+	Chinook Age-0	Chinook Age-1	Cutt	Bull	Brook Fry	Brook Parr	White	Total
Trapper Creek	7/7	PL	1	14	1	6.95	34.74	13.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	55.58
Trapper Creek		PW	1	247	4	0.77	2.12	0.79	0.00	0.00	0.41	0.00	0.00	0.00	0.00	4.08
Trapper Creek		RI	1	101	2	0.00	0.78	0.00	0.00	0.00	0.78	0.00	0.00	0.00	0.00	1.54
Trapper Creek		RU	1	84	2	2.41	2.41	0.00	0.00	0.00	2.41	0.00	0.00	0.00	0.00	7.23
Weir Creek	8/13	PL	1	136	3	1.32	8.25	3.80	0.00	1.32	5.75	0.00	0.00	0.00	0.00	20.43
Weir Creek		PW	1	665	5	10.07	1.71	0.28	0.00	0.00	0.67	0.00	0.00	0.00	0.00	12.74
Weir Creek		RI	1	931	8	2.74	2.96	0.25	0.00	0.00	1.64	0.00	0.00	0.00	0.00	7.59
Weir Creek		RU	1	504	6	6.27	4.58	0.81	0.00	0.00	5.01	0.00	0.00	0.00	0.00	16.67
Salmon River drainage																
Beaver Creek	8/18	PL	2	172	5	13.67	19.29	2.09	0.00	0.00	0.00	0.00	10.52	10.10	0.00	55.67
Beaver Creek		PW	2	89	3	13.28	5.90	0.00	0.00	0.00	0.00	0.00	4.94	2.59	0.00	26.71
Beaver Creek		RI	2	233	8	22.35	4.95	0.35	0.00	0.00	0.00	0.00	3.29	1.67	0.00	32.60
Beaver Creek		RU	2	538	14	19.93	3.65	1.57	0.00	0.00	0.00	0.00	13.14	8.64	0.00	46.93
Frenchman Creek	8/16	PL	1	76	4	31.89	6.12	0.89	0.00	0.00	0.00	0.00	0.00	17.20	0.00	56.10
Frenchman Creek	and	PW	1	102	3	29.99	8.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.75
Frenchman Creek	8/17	RI	1	100	5	18.11	3.92	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	22.87
Frenchman Creek		RU	1	478	15	38.41	3.53	0.63	0.00	0.00	0.00	0.00	0.51	2.71	0.00	45.79

Table 4. The weighted mean density (fish/100 m^2) of streams that were snorkeled in 2000. Trout fry = all trout (except brook trout) ≤75 mm; SH 1 = juvenile steelhead 76 mm to 127 mm; SH 2+ = juvenile steelhead >127 mm; CH 0 = age-0 chinook salmon; CH 1 = age-1 chinook salmon; Cutt = all cutthroat trout; Bull = all bull trout; Brook fry = all brook trout <75 mm; Brook parr = all brook trout ≥75 mm; White = all mountain whitefish. The percent change column is the percent change of this year's juvenile steelhead parr density (age-1 and -2+ combined) from 1999.

Stream	Strata	Trout Fry	Steelhead parr Age-1	Steelhead parr Age-2+	Chinook Age-0	Chinook Age-1	Cutt	Bull	Brook Fry	Brook Parr	White	Total Salmonid	Percent Change
Fish Creek	1	0.98	7.03	5.04	0.55	0.01	0.96	0.00	0.00	0.00	0.00	14.58	10.5%
Gedney Creek	1	8.05	5.54	4.14	0.25	0.03	0.18	0.05	0.00	0.00	0.34	18.58	-17.2%
	2	2.42	8.29	3.24	0.00	0.00	0.10	0.00	0.00	0.00	0.00	14.05	-1.6%
WF Gedney Creek	1	5.40	11.49	6.90	0.07	0.00	0.28	0.08	0.00	0.02	0.12	24.35	-12.8%
SF Red River	1	0.14	1.49	1.30	0.00	0.04	3.58	0.00	0.00	0.00	0.16	6.69	<0.5%
	2	0.06	0.16	0.24	0.00	0.00	3.00	0.03	0.00	0.23	0.00	3.72	-9.1%
	1 & 2	0.10	0.74	0.76	0.00	0.02	3.21	0.02	0.00	0.13	0.07	5.04	-15.3%
Bald Mountain Creek	1	1.52	4.42	2.07	0.00	0.00	4.50	0.11	0.00	0.00	0.00	12.63	5.7%
Boulder Creek[a]	1	0.68	4.93	3.65	0.06	0.01	0.97	0.04	0.00	0.02	0.00	10.37	-15.6%
Canyon Creek	1	3.06	3.79	3.62	0.00	0.00	1.07	0.00	0.00	0.00	0.00	11.55	-8.2%
Deadman Creek	1	17.37	6.17	1.19	0.09	0.00	0.44	0.00	0.00	0.00	0.00	25.25	44.8%
Weir Creek	1	5.67	3.37	0.59	0.00	0.06	2.61	0.00	0.00	0.00	0.00	12.30	-53.3%
Post Office Creek	1	14.98	3.34	1.37	0.00	0.00	0.41	0.00	0.00	0.00	0.00	20.10	97.0%
Beaver Creek	2	19.75	5.53	1.17	0.00	0.00	0.00	0.00	9.54	6.37	0.00	42.36	16.1%
Frenchman Creek	1	34.69	3.89	0.54	0.00	0.00	0.00	0.00	0.51	3.27	0.00	42.90	2506%

[a] No riffles were snorkeled in Boulder Creek. I assumed that riffle density = 0.75 * Pocket water density to calculate weighted stream density.

Table 5. The location, dates of trapping, number tagged, mean fork length, mean weight, and mean condition factor of juvenile steelhead that were captured in screw traps and PIT tagged in the Salmon River drainage during 2000. The Sawtooth trap was fished in the Salmon River at the Sawtooth Fish Hatchery. SD = standard deviation.

	Trapping dates		Fork length (mm)				Weight (g)			Condition factor	
Release site	**Start**	**End**	**Number**	**Mean**	**SD**	**Median**	**Number**	**Mean**	**SD**	**Mean**	**SD**
Spring period (start of trapping to May 31)											
Johnson Creek	3/1		182	124	52	67	182	27.5	24.9	0.96154	0.06448
Lake Creek	4/20		14	138	36	122	13	26.8	17.8	1.01874	0.07476
Lower SF Salmon River	2/23	4/24	40	180	14	183	40	58.2	13.7	0.97443	0.05110
Marsh Creek	3/16		25	185	39	211	25	69.0	37.6	0.98463	0.07753
Pahsimeroi River	3/2		241	186	26	141	241	66.5	26.6	0.98370	0.07545
Sawtooth Hatchery[a]	3/21		9	172	19	176	9	48.2	17.6	0.91957	0.05514
Secesh River	5/15		16	107	28	148	16	15.3	11.2	1.05039	0.10372
SF Salmon River, Knox bridge	2/23	5/17	10	162	20	155	10	44.1	14.4	1.00046	0.04748
WF Yankee Fork	3/27	5/26	46	131	36	129	46	26.6	19.4	0.97243	0.10931
Summer period (June 1 to August 31)											
Johnson Creek			521	173	19	173	520	55.0	17.7	1.02015	0.06963
Lake Creek			95	119	50	213	94	28.0	35.1	1.05707	0.09154
Lower SF Salmon River	7/13		24	142	28	137	2	32.0	20.2	1.15476	0.14863
Marsh Creek		6/22	7	168	21	163	7	57.7	25.1	1.15135	0.09043
Pahsimeroi River			40	136	36	104	40	33.8	26.7	1.10583	0.08396
Sawtooth Hatchery			14	167	16	166	14	51.8	15.1	1.07921	0.08282
Secesh River			361	107	46	65	361	21.4	27.0	1.05956	0.09582
SF Salmon River, Knox bridge	6/3		45	158	22	140	44	48.9	19.7	1.17222	0.10220
Fall period (September 1 to end of trapping)											
Johnson Creek		11/12	437	172	18	144	437	51.5	18.3	0.97390	0.05789
Lake Creek		10/30	33	150	40	170	31	41.2	36.8	1.06338	0.10887
Lower SF Salmon River		11/7	66	156	27	147	0	0.0	0.0	0.00000	0.00000
Pahsimeroi River		12/5	539	134	35	100	539	31.5	31.7	1.04087	0.12893
Sawtooth Hatchery		11/15	19	157	37	157	19	44.6	25.1	0.99295	0.09859
Secesh River		10/29	34	162	46	119	32	57.2	53.3	1.03331	0.06871
SF Salmon River, Knox bridge		10/24	31	151	30	121	24	40.4	24.6	1.04315	0.12826

Table 5 (Continued.)

Release site	Trapping dates		Fork length (mm)				Weight (g)			Condition factor	
	Start	End	Number	Mean	SD	Median	Number	Mean	SD	Mean	SD
Year totals											
Johnson Creek[b]	3/1	11/12	1,140	165	32	162	1,139	49.3	21.5	0.99304	0.06922
Lake Creek[b]	4/17	10/30	142	128	48	96	138	30.9	34.5	1.05488	0.09443
Lower SF Salmon River	3/1	11/7	130	161	28	143	42	56.9	14.8	0.98301	0.06733
Marsh Creek	3/15	6/22	32	181	36	158	32	66.5	35.2	1.02110	0.10555
Pahsimeroi River	3/1	12/5	820	150	40	163	820	41.9	34.0	1.02723	0.11792
Sawtooth Hatchery	3/16	11/15	42	164	28	155	42	47.8	20.4	1.00598	0.10288
Secesh River[b]	5/15	10/29	411	112	48	75	409	23.9	31.0	1.05715	0.09437
SF Salmon River, Knox bridge	3/1	10/24	86	156	25	164	78	45.7	20.9	1.11049	0.12717
WF Yankee Fork[c]	3/27	5/26	46	131	36	129	46	26.6	19.4	0.97243	0.10931

[a] We used a scoop trap during the spring trapping period and a screw trap during the summer and fall periods.
[b] Traps were operated by the Nez Perce Tribe.
[c] Trap was operated by the Shoshone-Bannock Tribe.

Table 6. The location, dates of trapping, number tagged, mean fork length, mean weight, and mean condition factor of juvenile steelhead that were captured in screw traps and PIT tagged in the Clearwater River drainage during 2000. SD = standard deviation.

	Trapping dates		Fork length (mm)				Weight (g)			Condition factor	
Release site	**Start**	**End**	**Number**	**Mean**	**SD**	**Median**	**Number**	**Mean**	**SD**	**Mean**	**SD**
Spring period (start of trapping to May 31)											
Clear Creek	4/12		204	165	16	173	200	43.9	12.4	0.96057	0.08860
Crooked Fork Creek	3/11		100	173	19	175	100	51.5	16.6	0.95849	0.07023
Fish Creek	3/16		68	149	34	118	67	34.6	17.8	0.98468	0.06587
Red River	3/22		95	101	36	78	95	14.5	18.1	0.96432	0.09293
White Sands Creek	3/23		56	180	20	182	54	54.2	14.2	0.89772	0.05518
Summer period (June 1 to August 31)											
Clear Creek		6/14	24	135	26	134	24	26.0	16.1	0.94335	0.06270
Crooked Fork Creek			274	139	41	109	273	35.4	26.8	1.05748	0.09842
Fish Creek			971	134	32	128	969	29.2	19.7	1.05292	0.09303
Red River			90	99	22	121	88	11.4	11.8	0.99731	0.08996
White Sands Creek			8	130	40	157	8	31.1	27.6	1.09662	0.21665
Fall period (September 1 to end of trapping)											
Crooked Fork Creek		11/10	316	168	21	183	316	49.6	18.1	1.00622	0.07262
Fish Creek		11/10	4,812	148	21	164	3,105	32.6	14.1	0.99760	0.06066
Red River		10/31	18	141	25	151	18	30.9	13.0	1.02846	0.09832
White Sands Creek		11/9	43	175	25	188	43	55.1	19.6	0.98189	0.05427
Year totals											
Crooked Fork Creek	3/11	11/10	690	157	34	172	689	44.2	22.9	1.01960	0.09026
Clear Creek[a]	4/12	6/14	228	161	20	157	224	42.0	14.0	0.95872	0.08625
Fish Creek	3/16	11/10	5,851	146	24	148	4,141	31.8	15.8	1.01034	0.07354
Red River[b]	3/22	10/31	203	104	32	80	201	14.6	16.0	0.98451	0.09402
White Sands Creek	3/24	11/9	107	174	27	186	105	52.8	18.7	0.94734	0.09688

[a] Trap was operated by US Fish and Wildlife Service.
[b] Trap was fished until 10/31 but steelhead caught after 10/4 were not tagged.

Table 7. The number of wild steelhead that were captured fly-fishing, electrofishing, and with minnow traps and PIT tagged in 2000.

Release site	Collection dates		Length (mm)				Weight (g)			Condition factor	
	Begin	End	Number	Mean	SD	Median	Number	Mean	SD	Mean	SD
Fish captured fly-fishing											
Boulder Creek	8/5	8/7	547	152	27	171	362	40.7	21.9	1.03331	0.08741
Deadman Creek	9/7	9/7	58	116	27	131	58	20.2	16.3	1.10073	0.07566
Fish Creek	6/27	7/16	572	148	29	150	558	39.5	24.0	1.08402	0.07164
Gedney Creek	7/31	8/28	732	140	26	138	723	31.1	18.0	1.03267	0.06641
O'Hara Creek	8/21	8/29	702	131	24	125	699	25.9	16.4	1.04345	0.07882
Fish captured electrofishing											
Bear Valley Creek	8/9	8/11	205	108	21	100	144	16.5	14.9	1.15603	0.11196
Elk Creek	8/11	8/11	80	107	18	94	80	15.7	11.9	1.17843	0.10344
Herd Creek	8/17	8/17	30	154	30	162	30	49.6	35.7	1.25670	0.15249
Secesh River	8/25	8/25	109	113	24	119	102	21.2	19.4	1.24594	0.11093
Valley Creek	8/14	8/16	87	136	25	128	43	35.6	20.8	1.21945	0.12001
Fish captured in minnow traps											
Fish Creek	3/16	6/24	114	95	16	89	114	9.4	5.2	1.01787	0.06341

Table 8. The number of wild steelhead that were tagged at screw traps that were fished during the spring, summer, and fall trapping periods in 2000 and the date that 10%, 25%, 50%, 75%, and 90% of the total number of steelhead were tagged. The Lower SF Salmon River trap was not fished from April 25 to July 13. The SF Salmon River, Knox Bridge trap was not fished from May 17 to June 3. The Lake Creek trap began fishing April 20 and the Secesh River trap began fishing on May 25. The Red River trap was fished until October 31, but steelhead captured after October 4 were not tagged.

Trap site	Number tagged	Date quantile was attained				
		10%	25%	50%	75%	90%
Crooked Fork Creek	690	4/10	6/22	8/25	9/5	9/14
Fish Creek	5,851	8/7	9/2	9/5	9/11	10/1
Red River	203	4/2	4/21	6/3	6/12	8/30
White Sands Creek	107	4/11	4/12	5/2	10/1	10/2
Johnson Creek	1,140	4/15	7/27	8/19	9/3	9/12
Pahsimeroi River	820	4/28	5/14	9/12	11/10	11/24
Lower SF Salmon River	130	4/14	4/22	9/4	9/7	10/3
Lake Creek	142	5/30	6/19	7/9	8/22	10/1
Secesh River	411	6/7	6/18	7/2	8/8	8/27
SF Salmon River, Knox Bridge	86	4/29	7/6	8/2	9/5	9/9

Table 9. The number of juvenile steelhead that were captured, marked, and recaptured (RE) at the Fish Creek screw trap in 2000 and the estimated number of juvenile steelhead that migrated past the trap (Migrants) with the 95% CI. P = trap efficiency estimate, Like = loglikelihood.

Period	Start date	End date	Catch	Fish marked	RE	p	Migrants	95% CI Lower	95% CI Upper	Like
1	3/16	4/3	26	19	7	0.38	68	39	150	-3.994
2	4/4	6/20	121	113	4	0.04	3,404	1,469	10,949	-4.914
3	6/21	7/3	196	157	18	0.12	1,704	1,120	2,792	-5.805
4	7/4	7/17	230	223	26	0.12	1,968	1,377	2,960	-6.066
5	7/18	7/31	62	58	7	0.12	509	266	1,178	-4.759
6	8/1	8/14	44	33	6	0.18	238	122	587	-4.441
7	8/15	8/28	408	293	78	0.27	1,530	1,255	1,901	-6.714
8	8/29	9/11	4,125	569	225	0.40	10,422	9,426	11,614	-8.205
9	9/12	9/30	550	346	144	0.42	1,319	1,154	1,527	-6.94
10	10/1	10/1	310	21	3	0.15	2,122	914	8,069	-5.129
11	10/2	10/15	343	256	76	0.30	1,153	945	1,435	-6.571
12	10/16	10/29	56	51	18	0.36	157	107	252	-4.866
13	10/30	11/11	23	19	6	0.32	70	38	171	-3.938
Fall period, 8/15 to 11/11							**16,773**	**14,980**	**22,771**	**-42.363**
Entire year							**24,663**	**21,476**	**32,373**	**-72.342**

Table 10. The mean growth rate (mm/day) and 95% CI of wild steelhead that were recaptured in 2000. Fish Creek growth rates were calculated for fish tagged in 2000 (0 winters) and fish that were tagged in 1999 (1 winter).

Stream	Winters	Number	Mean growth rate	95% CI
Fish Creek	0	138	0.18180	0.01357
Fish Creek	1	36	0.11706	0.01789
Gedney Creek	1	30	0.10522	0.01686
Storm Creek	1	38	0.07853	0.01077
White Sands Creek	1	15	0.06740	0.01562
Storm and White Sands combined	1	53	0.07538	0.00874

Table 11. The number of wild steelhead tagged and the number of smolts that were detected during 2000 at all Snake and Columbia River dams. Tagging periods were defined as: Pd1 = 2/23/00 to 5/31/00; Pd2 = 8/15/99 to 12/15/99; Pd3 = 6/1/99 to 8/14/99; Pd4 = 3/1/99 to 5/31/99; <1999 = all fish tagged before 1/1/99.

	Number of steelhead tagged				Number of MY 2000 detections from						Percent of fish detected				Percent ≥125 mm detected			
Release site	**Pd1**	**Pd2**	**Pd3**	**Pd4**	**All**	**Pd1**	**Pd2**	**Pd3**	**Pd4**	**<1999**	**Pd1**	**Pd2**	**Pd3**	**Pd4**	**Pd1**	**Pd2**	**Pd3**	**Pd4**
Clearwater River drainage																		
Crooked Fork Creek	100	157	119	150	177	47	94	36	0	0	47%	60%	30%	0%	47%	60%	43%	0%
Clear Creek	204	0	9	225	130	130	0	0	0	0	64%	-	0%	0%	64%	-	0%	0%
Fish Creek	161	7,441	880	71	4,247	31	3,765	316	8	127	19%	51%	36%	11%	52%	56%	43%	0%
Gedney Creek	0	269	406	0	174	0	60	61	0	53	-	22%	15%	-	-	30%	23%	-
O'Hara Creek	0	125	0	0	11	0	11	0	0	0	-	9%	-	-	-	14%	-	-
Red River	96	60	32	22	21	18	3	0	0	0	19%	5%	0%	0%	74%	19%	0%	0%
White Sands Creek	56	21	317	292	83	40	11	32	0	0	71%	52%	10%	0%	73%	52%	11%	0%
Salmon River drainage																		
Big Creek	0	110	0	0	2	0	2	0	0	0	-	2%	-	-	-	-	-	-
Bear Valley Creek	0	0	21	0	0	0	0	0	0	0	-	-	0%	-	-	-	0%	-
Camas Creek	0	0	95	0	4	0	0	4	0	0	-	-	4%	-	-	-	0%	-
Johnson Creek	184	207	244	62	192	54	71	43	0	24	29%	34%	18%	0%	57%	38%	33%	0%
Lake Creek	15	99	7	1	11	1	9	1	0	0	7%	9%	14%	0%	17%	11%	17%	0%
Lick Creek	0	540	81	0	53	0	45	8	0	0	-	8%	10%	-	-	11%	13%	-
Loon Creek	0	0	155	0	0	0	0	0	0	0	-	-	0%	-	-	-	0%	-
Lower SF Salmon River	40	187	109	114	136	34	81	21	0	0	85%	43%	19%	0%	85%	45%	30%	0%
Marsh Creek	25	34	55	6	16	5	4	7	0	0	20%	12%	13%	0%	21%	12%	18%	0%
Pahsimeroi River	246	280	78	634	144	102	40	2	0	0	41%	14%	3%	0%	42%	18%	3%	0%
Sawtooth trap	10	16	1	10	7	5	1	1	0	0	50%	6%	100%	0%	44%	8%	100%	0%
SF Salmon River	10	72	146	3	30	5	12	13	0	0	50%	17%	9%	0%	50%	18%	16%	0%
WF Yankee Fork	46	0	0	26	4	4	0	0	0	0	9%	-	-	0%	15%	-	-	0%

Table 12. The number of smolts detected during MY 2000, mean length (mm) of smolts and the 95% CI at the time of tagging (from August 15, 1999 to May 31, 2000), and the minimum and maximum smolt length (mm) from each release site.

Stream	Number detected	Mean length	95% CI (± mm)	Minimum length	Maximum length	Length quantile (mm)		
						10%	50%	90%
Clearwater River drainage								
Crooked Fork Creek	140	176	3	141	220	155	176	200
Clear Creek	130	165	3	130	240	145	164	187
Fish Creek	3,785	156	<1	109	209	134	154	181
Gedney Creek	60	157	5	127	217	133	155	184
O'Hara Creek	11	145	11	120	164	125	145	163
Red River	21	157	12	94	199	128	154	188
White Sands Creek	51	183	4	161	230	165	182	202
Salmon River drainage								
Johnson Creek	125	172	2	140	204	157	171	192
Lick Creek	45	160	5	132	200	143	156	189
Lower SF Salmon River	115	177	3	142	254	157	176	199
Marsh Creek	9	170	10	151	185	151	170	185
Pahsimeroi River	142	193	4	105	258	165	191	221
Secesh River	17	174	5	163	194	164	171	193
SF Salmon River, Knox Bridge	17	170	9	149	209	150	163	198

Table 13. Probabilities of all pairwise Tukey HSD comparisons of mean smolt length (at the time of tagging) of smolts that were detected in MY 2000 and tagged from August 15, 1999 to May 31, 2000. The pairwise length comparison probabilities in bold font are not significant at p = 0.05. CFCTRP = Crooked Fork Creek; CLEARC = Clear Creek; FISTRP = Fish Creek; GEDNEC = Gedney Creek; JOHTRP = Johnson Creek; LICKC = Lick Creek; LSFTRP = Lower SF Salmon River; PAHTRP = Pahsimeroi River; and WHITSC = White Sands Creek. The mean smolt length (mm) from each stream is shown in parentheses under the stream code in the first row or first column.

Stream code	**CFCTRP (176)**	**CLEARC (165)**	**FISTRP (156)**	**GEDNEC (157)**	**JOHTRP (172)**	**LICKC (160)**	**LSFTRP (177)**	**PAHTRP (193)**
CLEARC	<0.001							
FISTRP	<0.001	<0.001						
GEDNEC	<0.001	**0.107**	**1.000**					
JOHTRP	**0.853**	0.015	<0.001	<0.001				
LICKC	<0.001	**0.792**	**0.922**	**0.996**	0.001			
LSFTRP	**1.000**	<0.001	<0.001	<0.001	**0.545**	<0.001		
PAHTRP	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
WHITSC (183)	**0.274**	<0.001	<0.001	<0.001	0.014	<0.001	**0.602**	0.030

Table 14. The date that 10%, 25%, 50%, 75%, and 90% of total number of smolt detections were attained at Lower Granite Dam during MY 2000 from SSS tagging sites in the Clearwater and Salmon River drainages.

		Date quantile was attained					Duration of quantile block (days)			
Stream	**Number**	**10%**	**25%**	**50%**	**75%**	**90%**	**10 to 25%**	**25 to 50%**	**50 to 75%**	**75 to 90%**
Clearwater drainage										
Crooked Fork Creek	87	4/14	4/16	4/17	4/21	5/2	2	1	4	11
Clear Creek	83	4/21	4/30	5/5	5/8	5/14	9	5	3	6
Fish Creek	2,346	4/13	4/16	4/20	5/1	5/7	3	4	11	6
Gedney Creek	83	4/10	4/15	4/18	4/24	5/3	5	3	6	9
White Sands Creek	46	4/17	4/18	4/22	5/2	5/7	1	4	10	5
Red River	11	4/24	4/30	5/3	5/6	5/20	6	3	3	14
Salmon River drainage										
Johnson Creek	111	4/14	4/18	4/24	5/5	5/8	4	6	11	3
Lick Creek	34	4/16	4/24	4/29	5/6	5/22	8	5	7	16
Lower SF Salmon River	90	4/13	4/19	4/24	5/3	5/7	6	5	9	4
Marsh Creek	14	4/25	5/2	5/7	5/23	5/26	7	5	16	3
Pahsimeroi River	109	4/20	5/2	5/6	5/20	5/24	12	4	14	4
SF Salmon River, Knox Bridge	19	4/12	4/18	4/29	5/7	5/8	6	11	8	1
All sites combined	**3,874**	**4/14**	**4/17**	**4/22**	**5/5**	**5/11**	**3**	**5**	**13**	**6**

Table 15. The median smolt travel time and 90% CI of steelhead smolts from release site to Lower Granite Dam (LGR). Fish were tagged and detected during MY 2000.

	Number	**Distance**	**Travel time (days)**			**Travel time (km/day)**		
Stream	**detected**	**to LGR (km)**	**Median**	**Lower**	**Upper**	**Median**	**Upper**	**Lower**
Clearwater River drainage								
Crooked Fork Creek	23	324	9.0	6	11	36.0	54.0	29.5
Clear Creek	83	176	4.0	4	5	44.0	44.0	35.2
Fish Creek	18	248	23.5	16	29	10.6	15.5	8.6
Red River	11	278	14.0	6	21	19.9	46.3	13.2
White Sands Creek	23	322	8.0	6	9	40.3	53.7	35.8
Salmon River drainage								
Johnson Creek	33	407	13.0	11	14	31.3	37.0	29.1
Lower SF Salmon River	23	403	10.0	8	12	40.3	50.4	33.6
Pahsimeroi River	75	621	9.0	9	10	69.0	69.0	62.1

Table 16. The streams that crews collected juvenile steelhead fin samples for DNA analysis in 2000. Fish were collected fly-fishing in July and August unless noted otherwise.

Stream	Drainage	Number of Samples	Notes
Big Smoky Creek	Boise	60	
Big Canyon Creek	Clearwater	9	collected electrofishing in May and June
Clear Creek	Clearwater	60	
EF Potlatch River	Clearwater	52	collected electrofishing in June
Jacks Creek	Clearwater	41	collected electrofishing in May and June
Little Bear Creek	Clearwater	58	collected electrofishing in June
Mission Creek	Clearwater	52	collected electrofishing in June
Dworshak	Hatchery	102	
EF Salmon "B-run"	Hatchery	103	
Oxbow	Hatchery	101	
Pahsimeroi	Hatchery	102	
Sawtooth	Hatchery	93	
Boulder Creek	Little Salmon	63	
Hazard Creek	Little Salmon	61	
Little Salmon upstream of falls	Little Salmon	68	
Little Salmon, Pinehurst area	Little Salmon	68	
Rapid River	Little Salmon	61	collected upstream of the hatchery
Boulder Creek	Lochsa	61	
Brushy Fork Creek	Lochsa	60	
Canyon Creek	Lochsa	59	
Colt Creek	Lochsa	69	
Crooked Fork Creek	Lochsa	57	collected upstream of Brushy Fork Creek
Deadman Creek	Lochsa	59	
Fish Creek (summer collection)	Lochsa	62	collected fly-fishing in July
Fish Creek (fall migrants)	Lochsa	70	collected at screw trap after September 1
Hungery Creek	Lochsa	66	
Lake Creek	Lochsa	59	
Papoose Creek	Lochsa	55	
Storm Creek	Lochsa	70	
Warm Springs Creek	Lochsa	60	
Weir Creek	Lochsa	67	
Bear Valley Creek	MF Salmon	62	
Big Creek (lower 3 km)	MF Salmon	78	
Big Creek (upper)	MF Salmon	49	
Camas Creek	MF Salmon	69	
Loon Creek	MF Salmon	67	
Marsh Creek	MF Salmon	62	
Pistol Creek	MF Salmon	30	
Rapid River	MF Salmon	62	
Sulphur Creek	MF Salmon	67	
Collins Creek	NF Clearwater	59	collected September 2 and 3
MF Payette River	Payette	56	

Table 16. (Continued.)

Stream	Drainage	Number of Samples	Notes
Bargamin Creek	Salmon	61	
Basin Creek	Salmon	61	
Chamberlain Creek	Salmon	69	
Horse Creek	Salmon	62	
Lemhi River	Salmon	53	collected at screw trap
Morgan Creek	Salmon	62	
Owl Creek	Salmon	61	
Sheep Creek	Salmon	22	
Slate Creek (near Whitebird)	Salmon	58	
Valley Creek	Salmon	52	collected electrofishing in August
Warm Springs Creek	Salmon	55	
Whitebird Creek	Salmon	61	
Pahsimeroi River	Salmon	70	collected at screw trap
WF Yankee Fork	Salmon	58	
Bear Creek	Selway	59	
EF Moose Creek	Selway	66	
Gedney Creek	Selway	71	
Meadow Creek	Selway	54	
Mink Creek	Selway	59	
NF Moose Creek	Selway	67	
O'Hara Creek	Selway	60	
Pettibone Creek	Selway	58	
Three Links Creek	Selway	61	
Johns Creek	SF Clearwater	50	
Ten Mile Creek	SF Clearwater	50	
Red River	SF Clearwater	30	collected at screw trap in October
EF SF Salmon River	SF Salmon	67	
Johnson Creek	SF Salmon	67	
Lick Creek (lower)	SF Salmon	69	
Lick Creek (upstream of barrier)	SF Salmon	70	
Poverty Flat area	SF Salmon	60	
Secesh River	SF Salmon	70	
Stolle Meadow	SF Salmon	52	collected at Knox bridge screw trap
Captain John Creek	Snake	57	collected electrofishing in August
Granite Creek	Snake	50	collected electrofishing in August
Sheep Creek	Snake	50	collected electrofishing in August
Little Weiser River	Weiser	59	

Table 17. Streams that had water temperatures recorded in 2000. The winter recording interval in the Salmon River drainage was used from January 1 to April 30 and from October 24 to December 31, 2000. The winter recording interval in the Clearwater River drainage was used from January 1 to March 23 and from October 30 to December 31, 2000. Air temperature, relative humidity, and barometric pressure was measured at the Fish Creek trailhead. The water temperature was measured within 1 km of the mouth of each stream unless noted. NR = not recorded.

Stream	Recording interval (hours)	
	Winter	Other
Salmon River drainage		
Basin Creek, 500 m upstream of hot springs	2.5	1.5
Beaver Creek, 2 km upstream of irrigation diversion	1.0	1.0
East Fork Salmon River, upstream of Bowery hot springs	2.5	1.5
East Fork Salmon River	2.5	1.5
Frenchman Creek, first meadow upstream of mouth	1.0	1.0
Germania Creek	2.5	1.5
Marsh Creek, 100m downstream of screw trap site	2.5	1.5
Pole Creek, 2 km upstream of irrigation diversion	1.0	1.0
Redfish Lake Creek at weir	2.5	1.5
Salmon River at Sawtooth Hatchery	2.5	1.5
Smiley Creek, 3km upstream of Highway 75	1.0	1.0
Valley Creek, 200 m upstream of Meadow Creek	2.5	1.5
West Pass Creek, at irrigation diversion	2.5	1.5
Clearwater River drainage		
Bald Mountain Creek	2.0	1.0
Bimerick Creek	2.0	1.0
Boulder Creek	1.0	1.0
Brushy Fork Creek	1.0	1.0
Canyon Creek	2.0	1.0
Crooked Fork Creek, 50 m upstream of Brushy Fork Creek	1.0	1.0
Deadman Creek	2.0	1.0
Fish Creek #1, at tag site	0.5	0.5
Fish Creek #2, 100m upstream of tag site	1.0	0.5
Fish Creek #3, 2 km upstream of Hungery Creek	1.0	1.0
Fish Creek, Air temperature	2.0	1.0
Fish Creek, Barometric pressure	NR	1.0
Fish Creek, Relative humidity	NR	1.0
Gedney Creek #1	1.0	0.5
Gedney Creek #2, upstream of mouth about 2 km	1.0	1.0
Hungery Creek	1.0	1.0
Lost Creek	2.0	1.0
O'Hara Creek, 2 km downstream of Hanby Fork	2.0	1.0
Post Office Creek	2.0	1.0
Red River, 1km upstream of SF Red River	1.0	1.0
SF Red River #1, at Schooner Creek	1.0	1.0
SF Red River #2, 1.5 km upstream of Trapper Creek	1.0	1.0
Squaw Creek	2.0	1.0
Trapper Creek	1.0	1.0
Weir Creek	2.0	1.0
Wendover Creek	2.0	1.0
WF Gedney Creek	1.2	1.2
Willow Creek (tributary of Fish Creek)	1.0	1.0

Table 18. The number of bull trout, cutthroat trout, chinook salmon parr, and dace that were captured and PIT tagged at the Fish Creek screw trap in 2000. Dace spp. = dace that were not identified to species. The length data for dace has not been analyzed (NA).

Species	Number trapped	Number PIT-tagged	Mean length (mm)	95% CI (± mm)	Minimum length (mm)	Maximum length (mm)
Bull trout	16	14	330	27	255	436
Cutthroat trout	491	265	221	8	104	385
Chinook salmon parr	377	353	89	<1	71	101
Longnose dace	1,381	0	NA			
Shortnose dace	552	0	NA			
Dace spp.	1,008	0	NA			

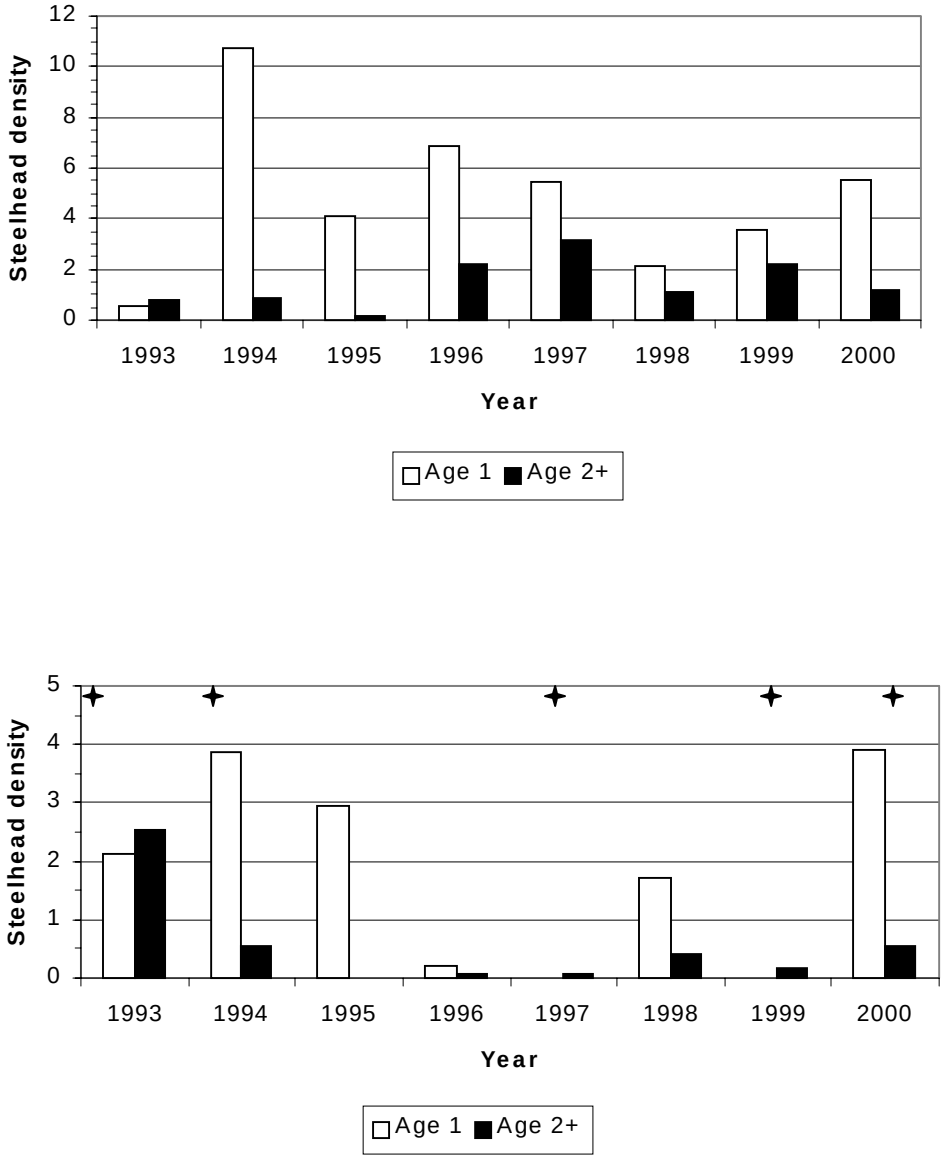
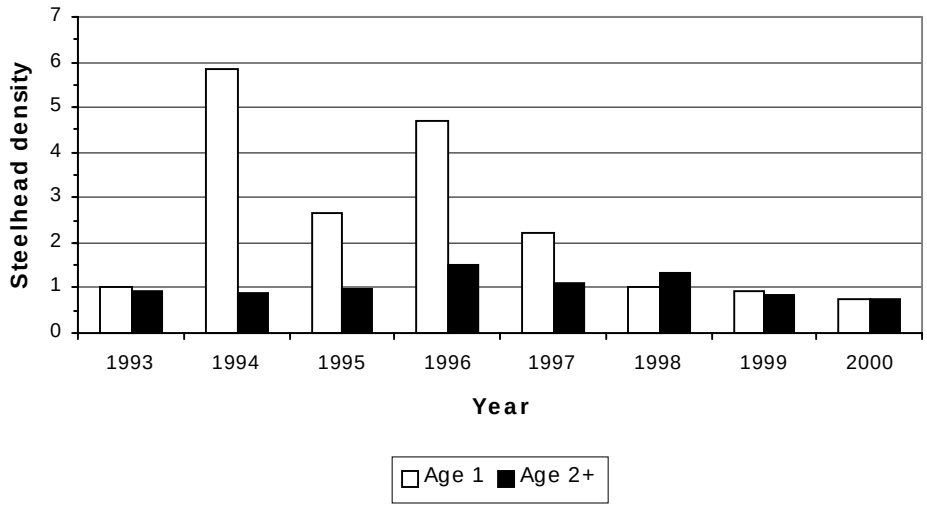


Figure 1. The weighted stream density (fish/100 m^2) of age-1 and age-2+ steelhead in Beaver Creek (top graph) and Frenchman Creek (bottom graph) from 1993 to 2000. The years that adult hatchery steelhead were stocked in Frenchman Creek are marked with a star.



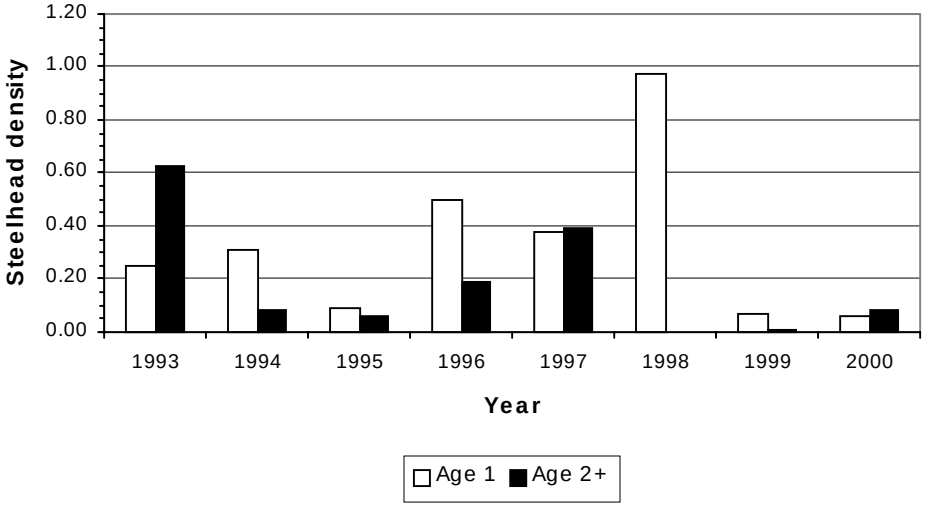


Figure 2. The weighted stream density (fish/100 m^2) of age-1 and age-2+ steelhead from 1993 to 2000 in the SF Red River (top graph) and Red River (bottom graph) upstream of the South Fork Red River.

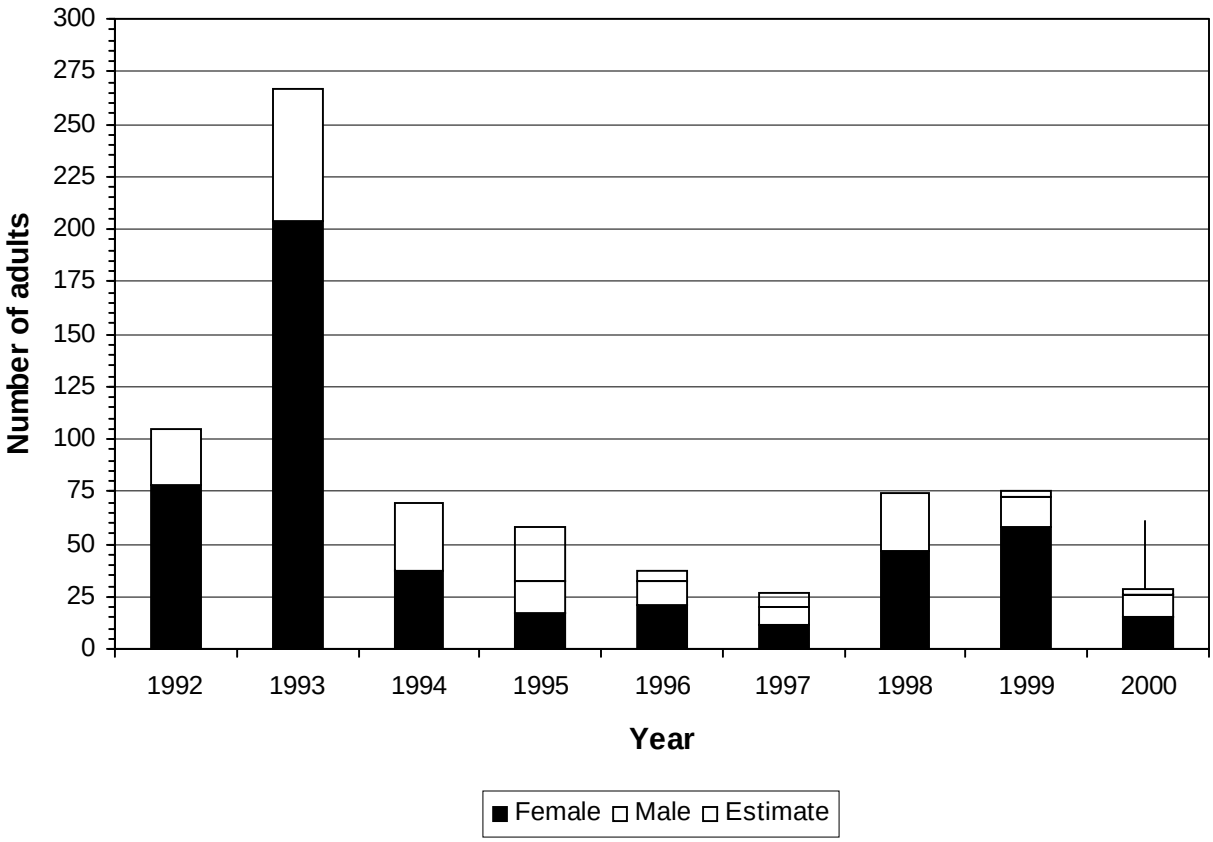


Figure 3. The steelhead escapement in Fish Creek from 1992 to 2000 based on the number of adult steelhead trapped at the weir and the number of unmarked kelts that were recovered. The weir was intact for the entire spawning season in 1992 to 1994, 1998, and 2000. The weir was opened on May 2, 1995 to prevent otter predation, and breached in three years on May 18, 1996, May 11, 1997, and May 24, 1999. The open rectangle in the years 1995, 1996, 1997 is the estimated number of adults that entered the stream after the weir was opened based on the mean proportion of adults that had arrived in the years the weir was intact. The open rectangle in the year 2000 is the maximum likelihood estimate of the escapement and the line is the upper 95% CI.

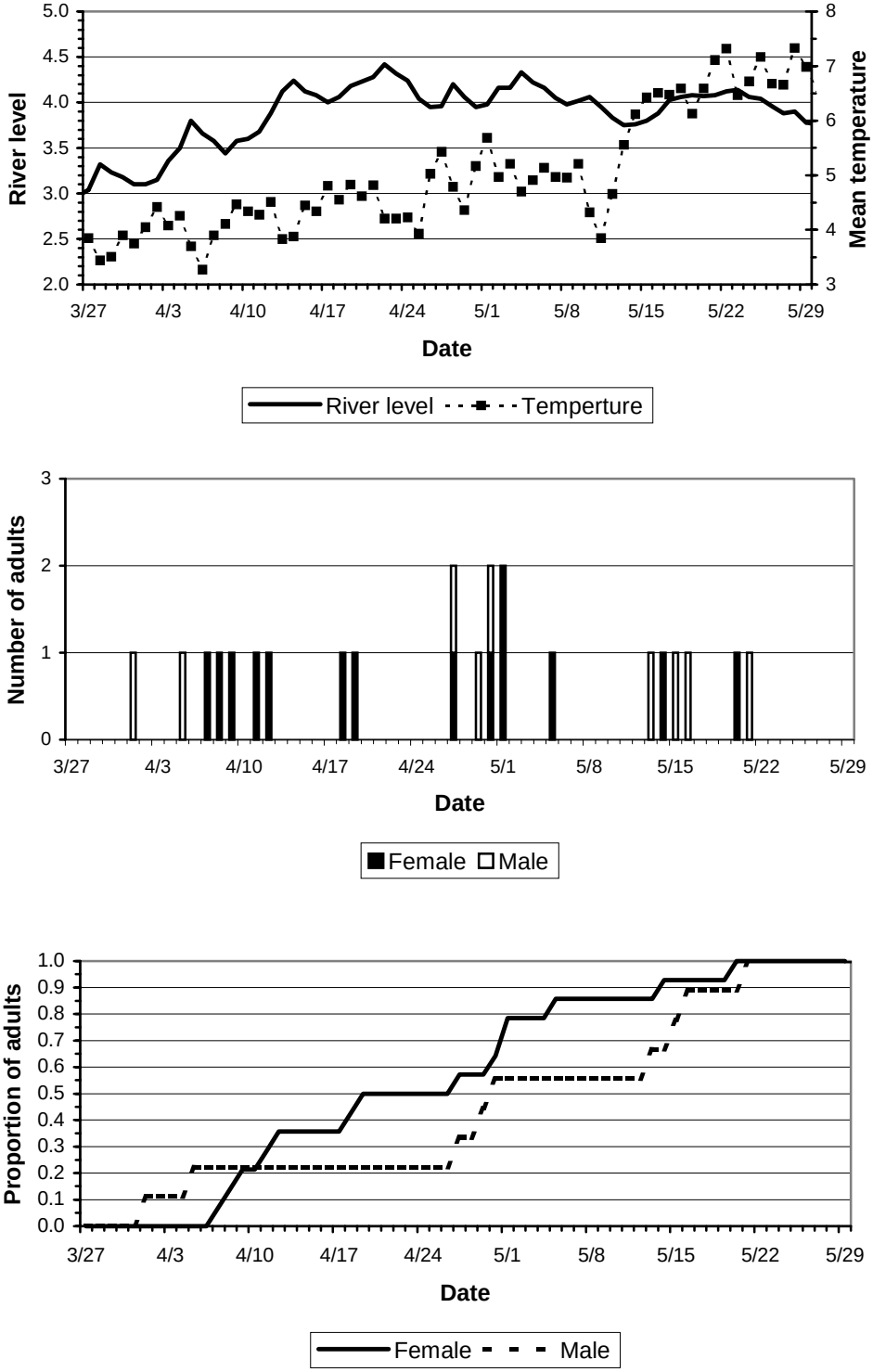


Figure 4. The daily river level and mean stream temperature (top), number of adult steelhead trapped daily at the weir (middle), and the cumulative proportion of adults that were trapped daily (bottom) in Fish Creek during 2000.

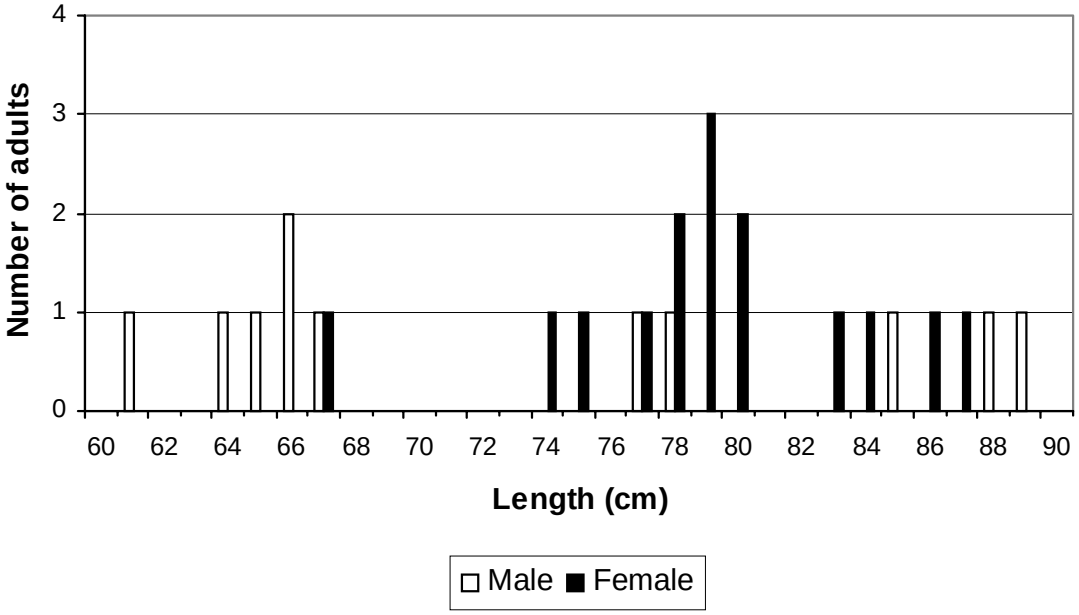


Figure 5. The length frequency of male and female wild steelhead that were captured at the Fish Creek weir in 2000.

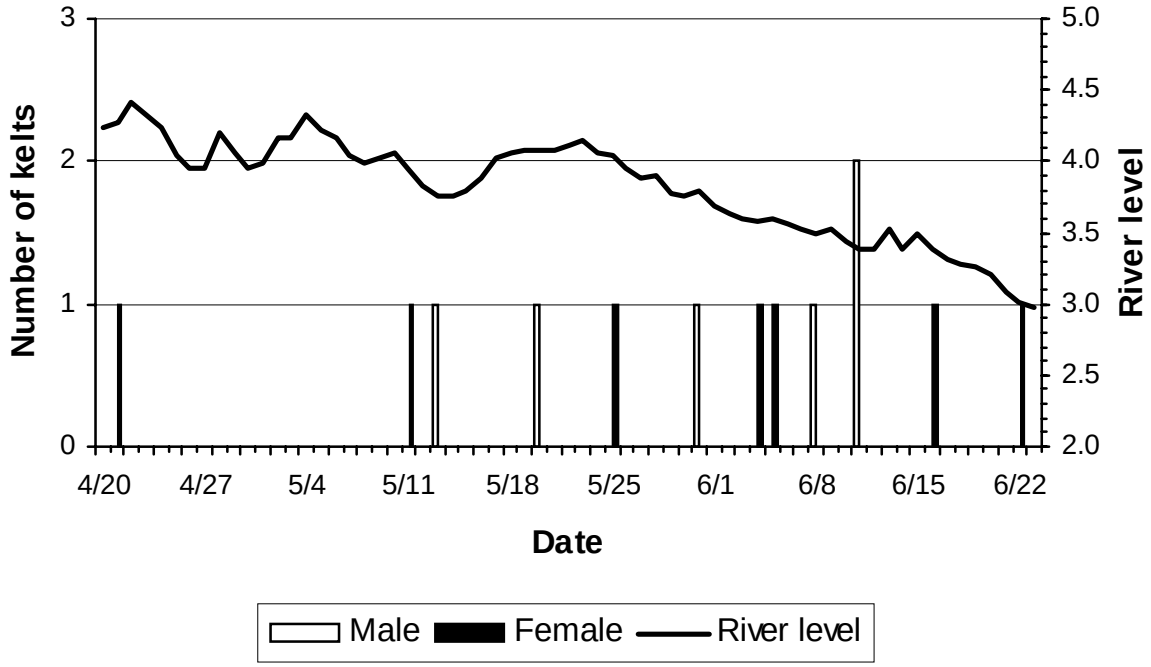


Figure 6. The daily river level and the number of male and female steelhead kelts captured at the Fish Creek weir in 2000.

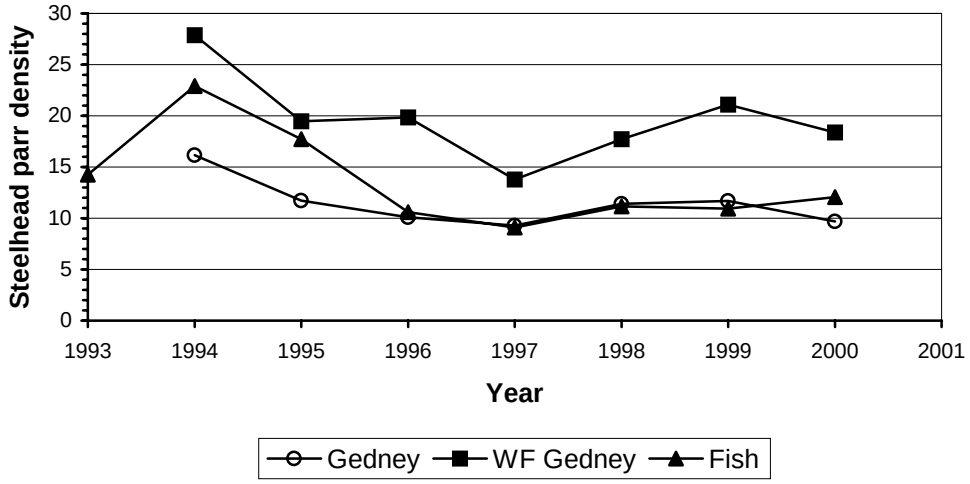


Figure 7. The weighted stream density (fish/100 m^2) of all juvenile steelhead (except fry) in Fish Creek, WF Gedney Creek, and Gedney Creek from its mouth upstream to the WF Gedney Creek.

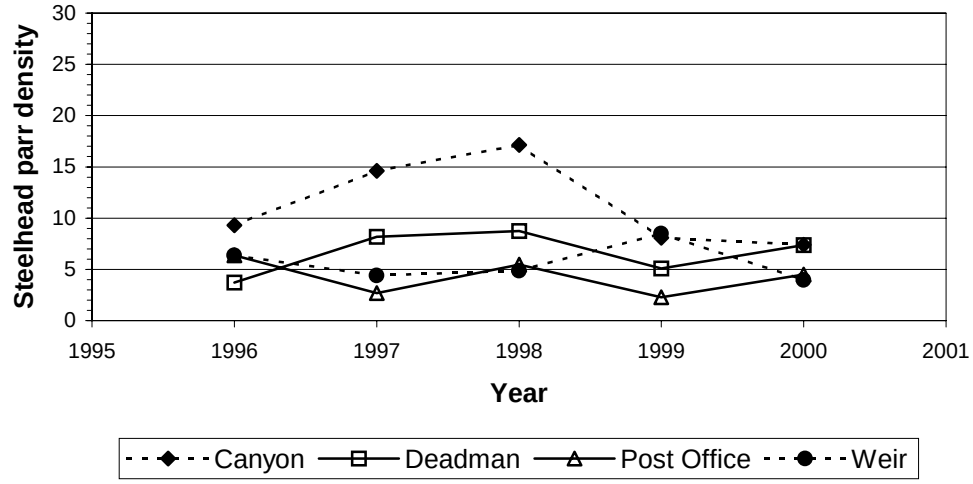
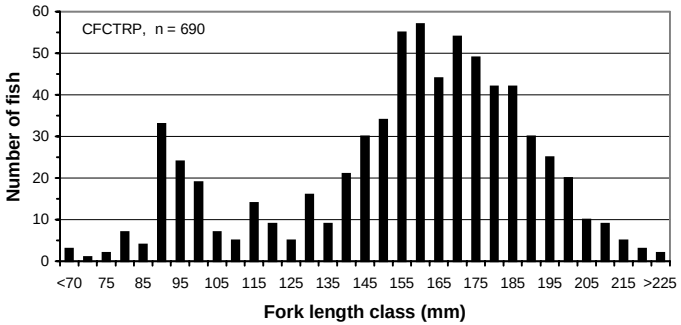
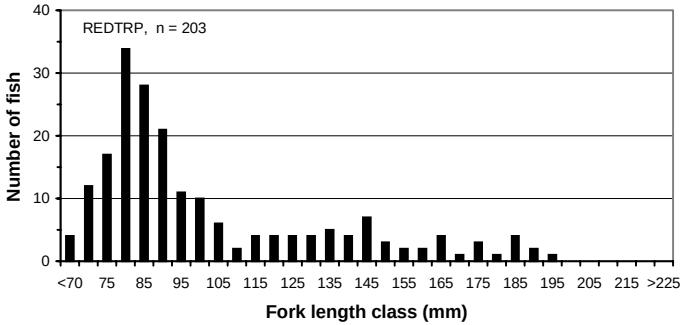
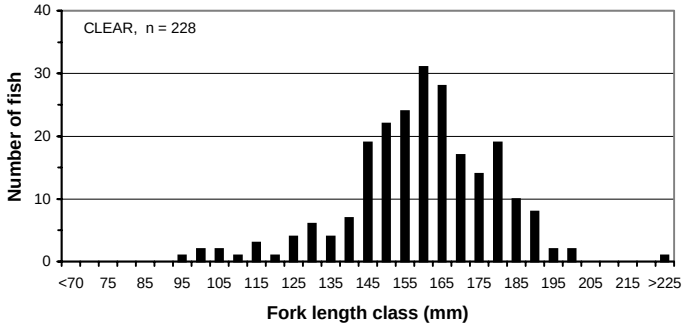
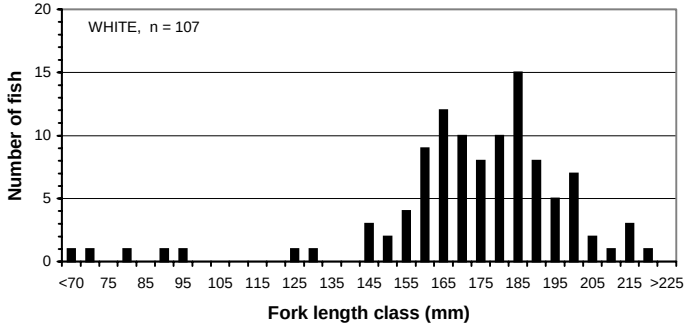


Figure 8. The weighted stream density (fish/100 m^2) of all juvenile steelhead (except fry) in the Lochsa River tributaries Canyon, Deadman, Post Office, and Weir creeks.









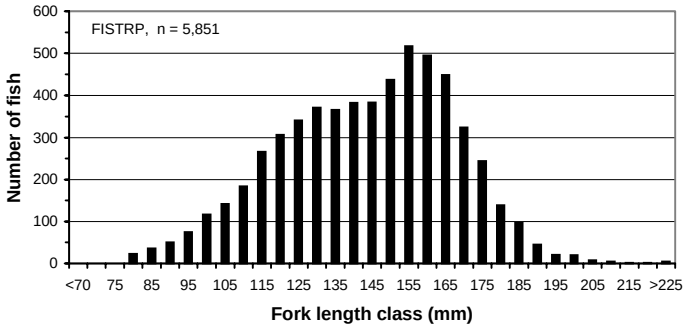


Figure 9. The length frequency of juvenile steelhead that were captured in screw traps and PIT tagged in the Clearwater River drainage in 2000. CFCTRP = Crooked Fork Creek, REDTRP = Red River, CLEARC = Clear Creek, WHITE = White Sands Creek, FISTRP = Fish Creek.

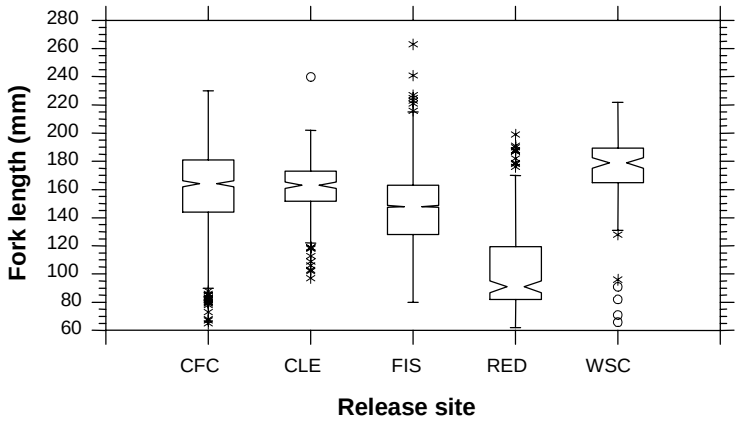


Figure 10. Box plot of fork length of PIT-tagged wild steelhead juveniles that were captured in screw traps in the Clearwater River drainage. The 95% CI of the median length is displayed with a notch. The upper edge of the box is the 75% percentile of length, and the lower edge of the box is the 25% percentile of length. CFC = Crooked Fork Creek; CLE = Clear Creek; FIS = Fish Creek; RED = Red River; WSC = White Sands Creek.

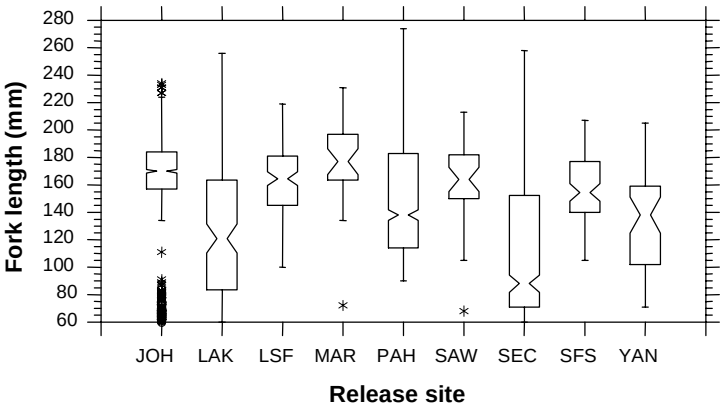


Figure 11. Box plot of fork length of PIT-tagged wild steelhead juveniles that were captured in screw traps in the Salmon River drainage. The 95% CI of the median length is displayed with a notch. The upper edge of the box is the 75% percentile of length and the lower edge of the box is the 25% percentile of length. JOH = Johnson Creek; LAK = Lake Creek; LSF = Lower SF Salmon River; MAR = Marsh Creek; PAH = Pahsimeroi River; SAW = Salmon River at Sawtooth Hatchery, SEC = Secesh River; SFS = SF Salmon River; YAN = WF Yankee Fork.

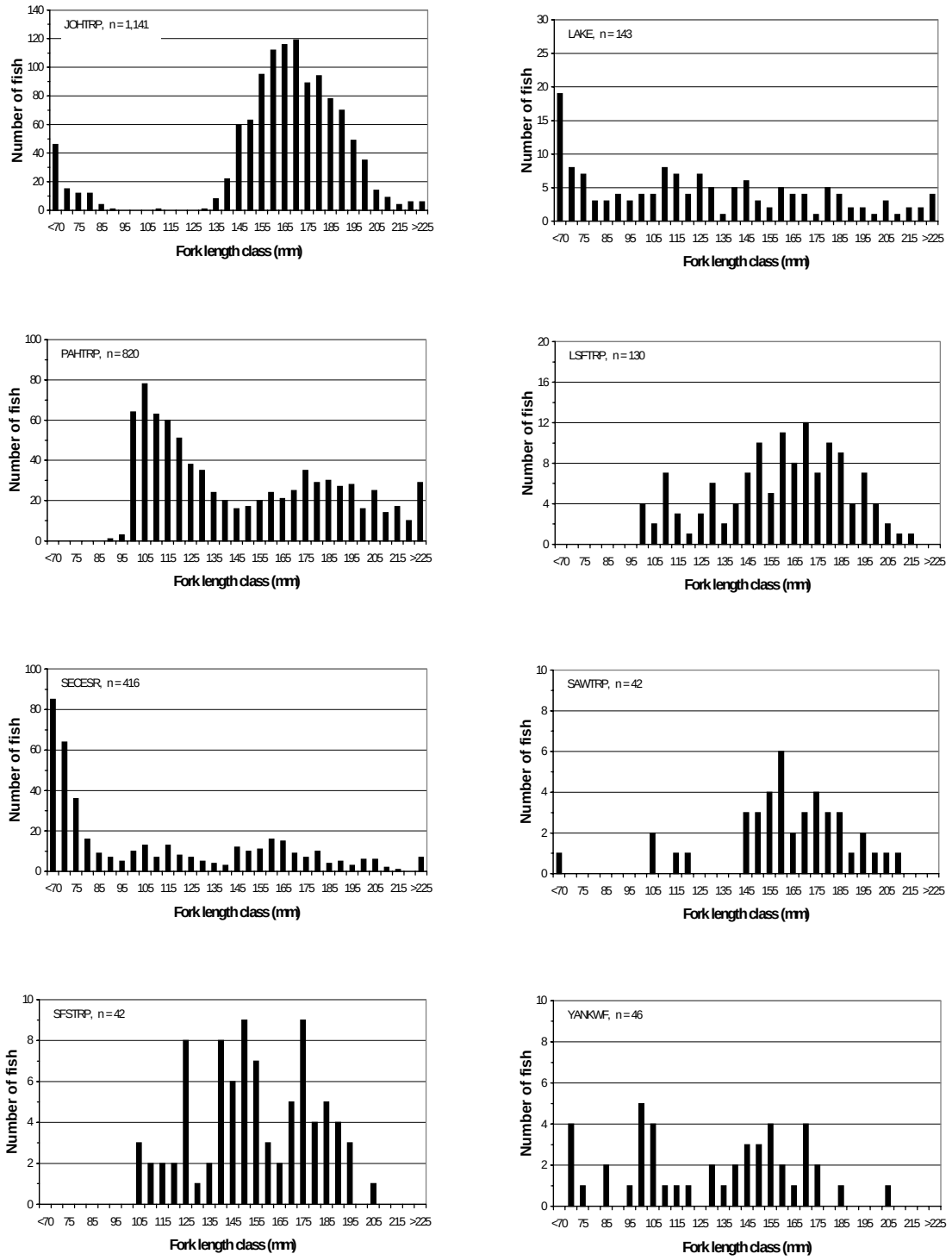


Figure 12. The length frequency of PIT-tagged wild steelhead that were captured at screw traps fished in Salmon River tributaries in 2000. JOHTRP = Johnson Creek, LAKE = Lake Creek, PAHTRP = Pahsimeroi River, LSFTRP = Lower SF Salmon River, SECSER = Secesh River, SAWTRP = Salmon River at Sawtooth Hatchery, SFSTRP = SF Salmon River at Knox Bridge, YANKWF = WF Yankee Fork. Marsh Creek data was not plotted (n = 32, fished only in the spring).

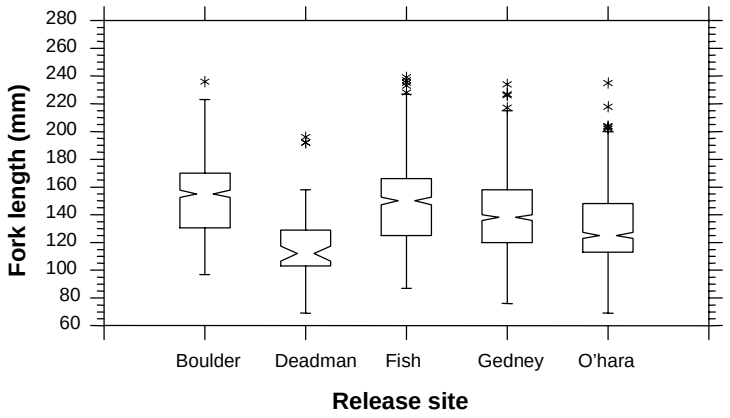


Figure 13. Box plot of fork length of PIT-tagged wild steelhead juveniles that were captured fly-fishing in tributaries of the Clearwater River drainage. The 95% CI of the median length is displayed with a notch. The upper edge of the box is the 75% percentile of length, and the lower edge of the box is the 25% percentile of length.

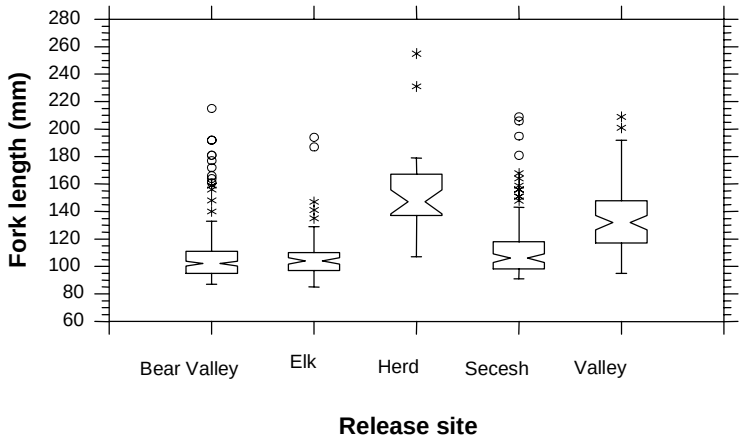


Figure 14. Box plot of fork length of PIT-tagged wild steelhead juveniles that were captured electrofishing in tributaries of the Salmon River drainage. The 95% CI of the median length is displayed with a notch. The upper edge of the box is the 75% percentile of length, and the lower edge of the box is the 25% percentile of length.

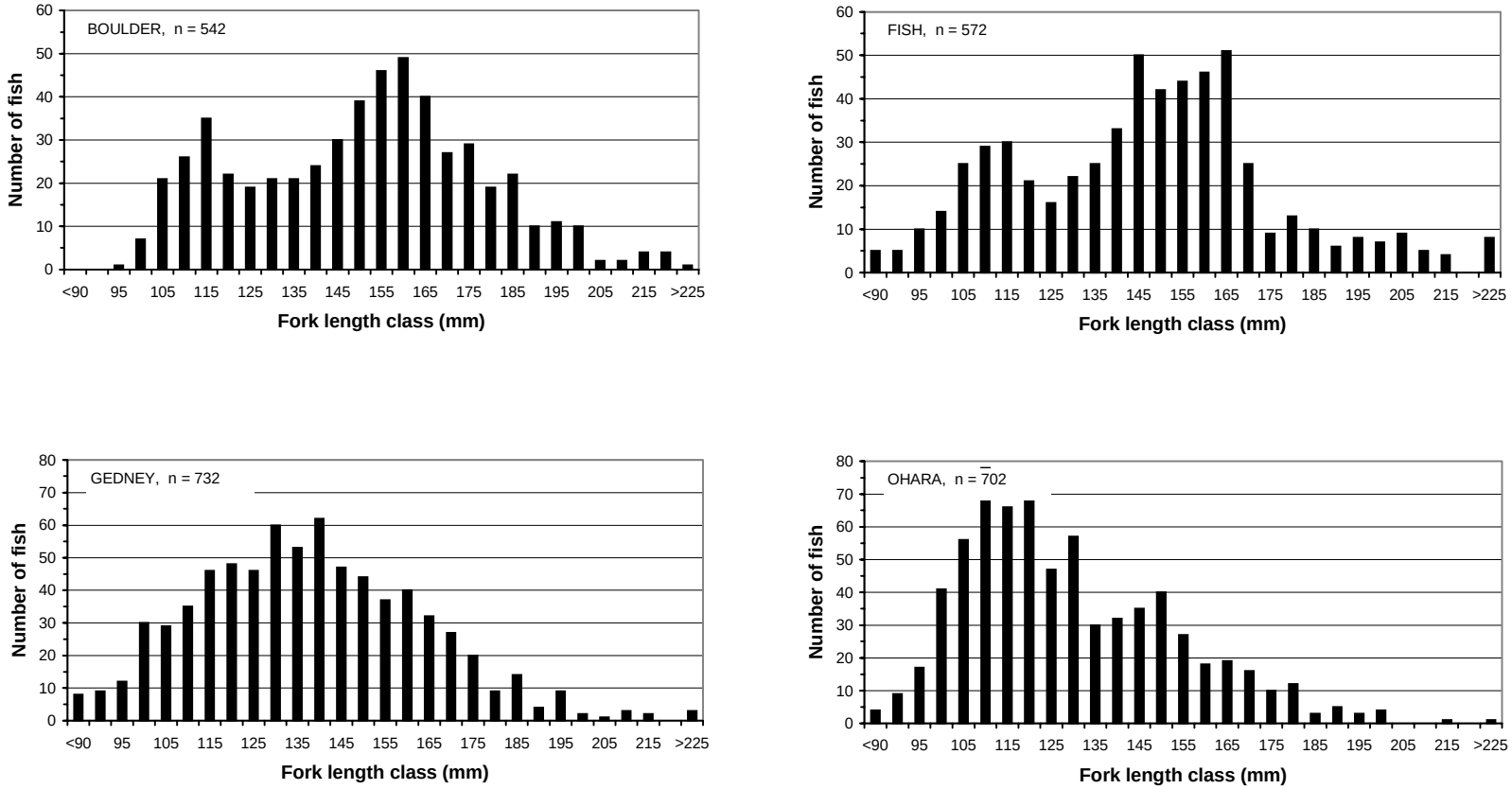


Figure 15. The length frequency of PIT-tagged wild steelhead that were captured fly-fishing in Clearwater River tributaries during the summer 2000. The Gedney plot includes fish caught in West Fork Gedney Creek.

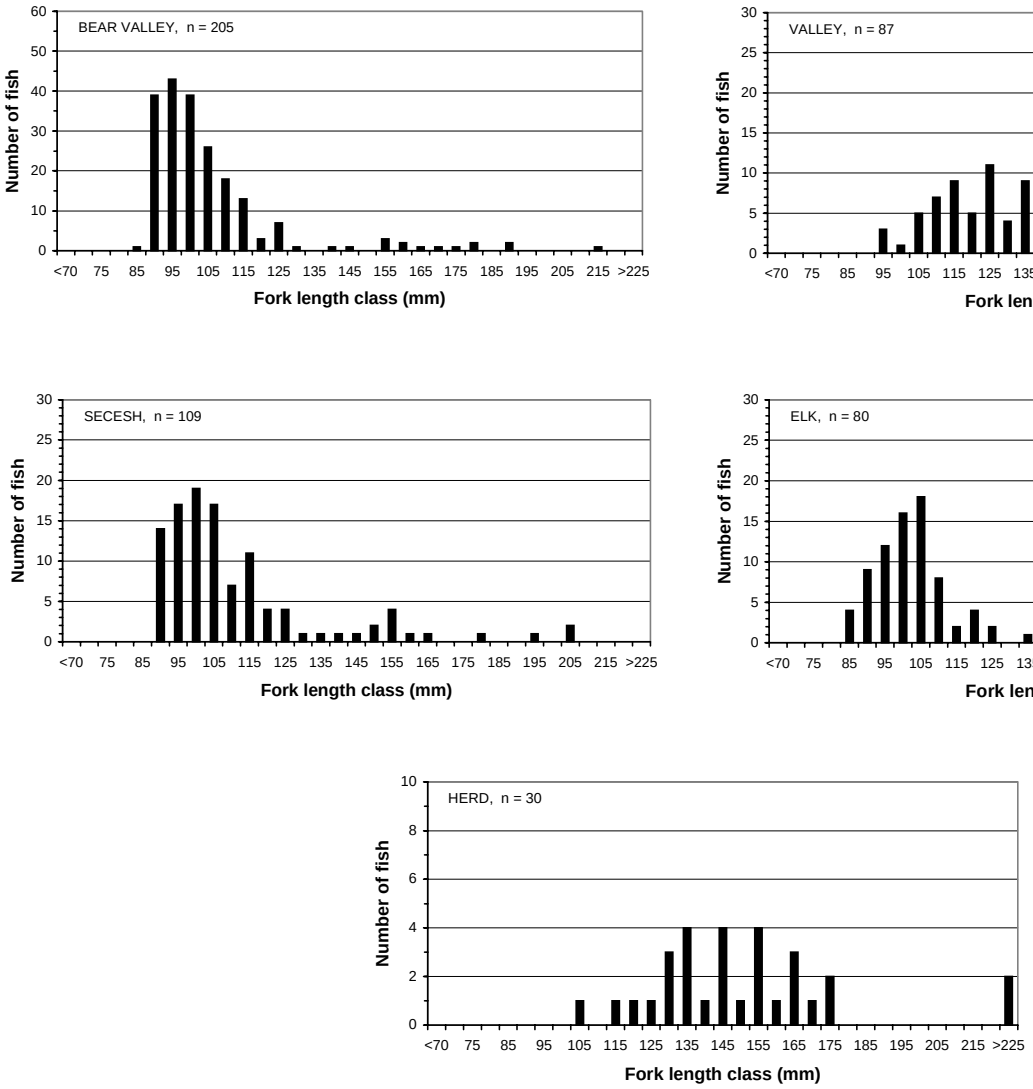


Figure 16. The length frequency of PIT-tagged wild steelhead that were captured electrofishing in Salmon River tributaries during the summer 2000.

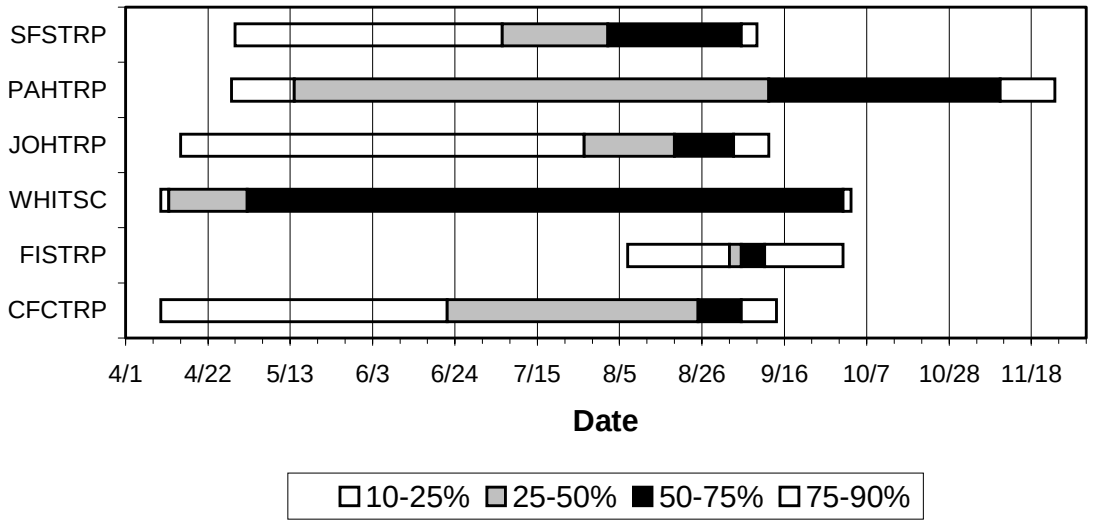


Figure 17. The date that 10%, 25%, 50%, 75%, and 90% of the total number of steelhead tagged at screw traps in 2000 was attained. The left edge of each block is the date that the lower quantile of the block was reached. CFCTRP = Crooked Fork Creek, FISTRP = Fish Creek, WHITSC = White Sands Creek, JOHTRP = Johnson Creek, PAHTRP = Pahsimeroi River, SFSTRP = SF Salmon River at Knox bridge.

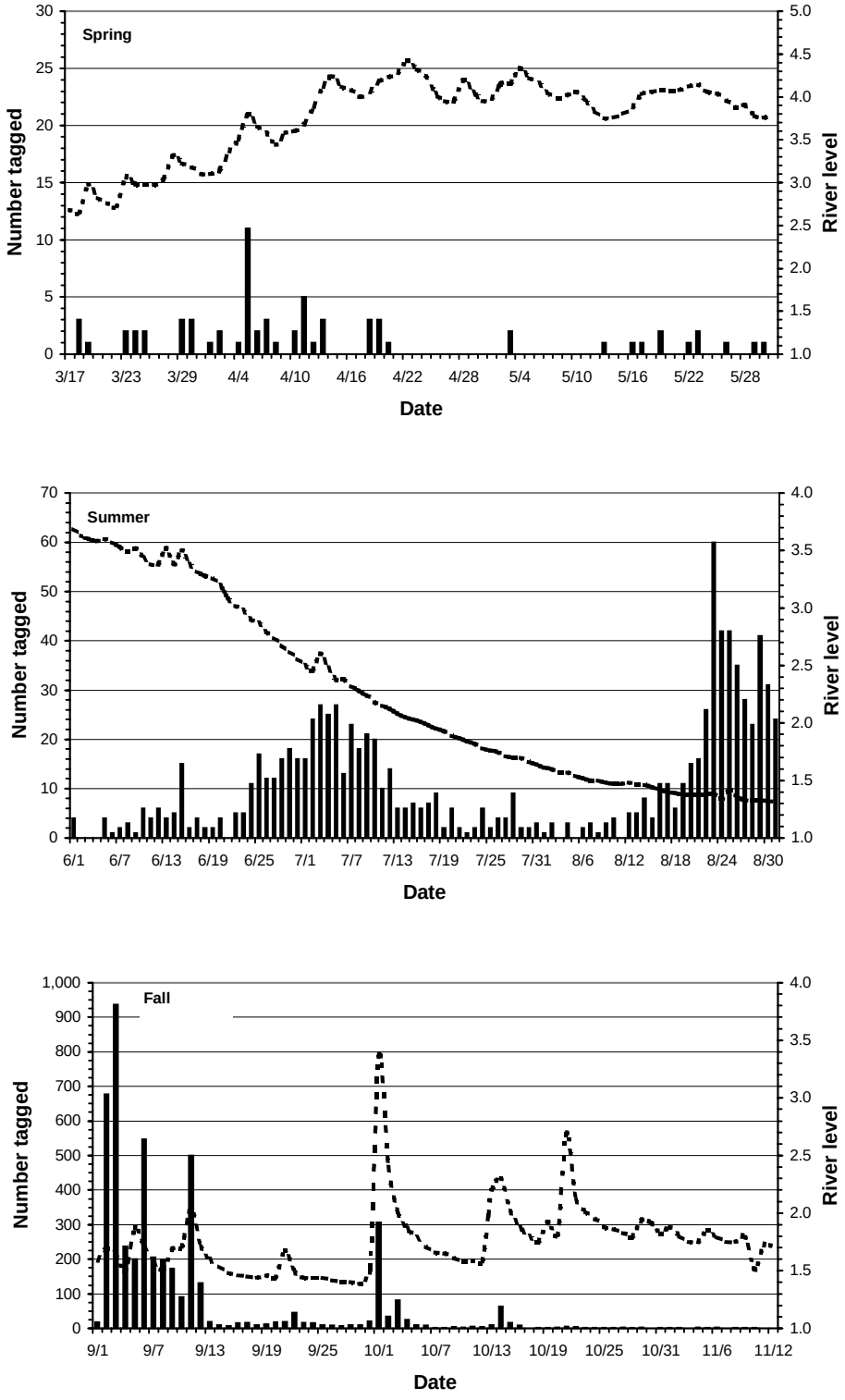
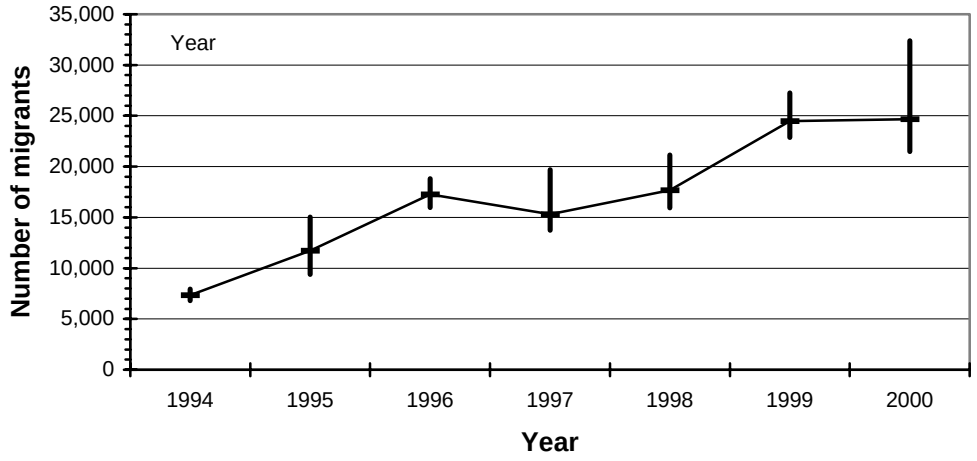


Figure 18. The daily number of juvenile steelhead that were PIT tagged and the daily river level in Fish Creek during the spring, summer, and fall trapping periods in 2000.



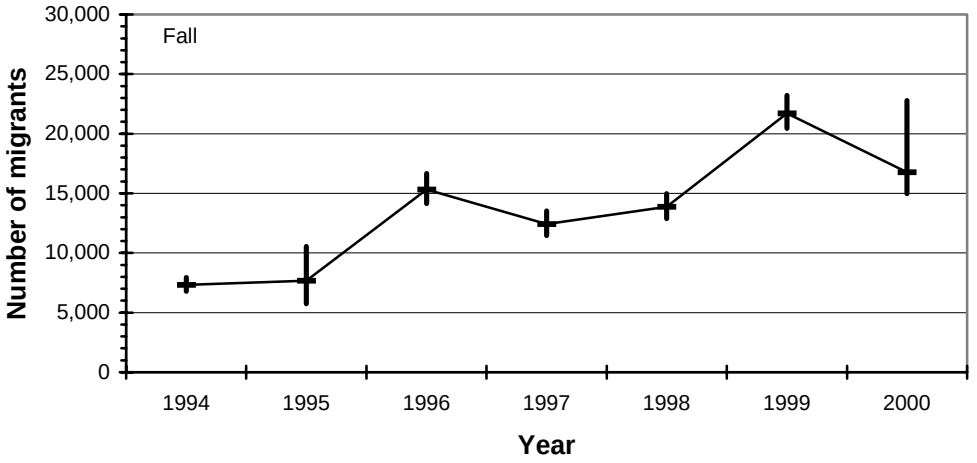


Figure 19. The number of juvenile steelhead and 95% CI that migrated past the screw trap in Fish Creek during the entire trapping season (Year, top graph) and from August 15 to the end of trapping in November (Fall, bottom graph) from 1994 to 2000. In 1994, the trap was fished from September 22 to November 2. In 1995, the trap was fished from March 16 to June 14 and from August 18 to November 2. Beginning in 1996, we have fished the trap, conditions permitting, from mid-March until early November.

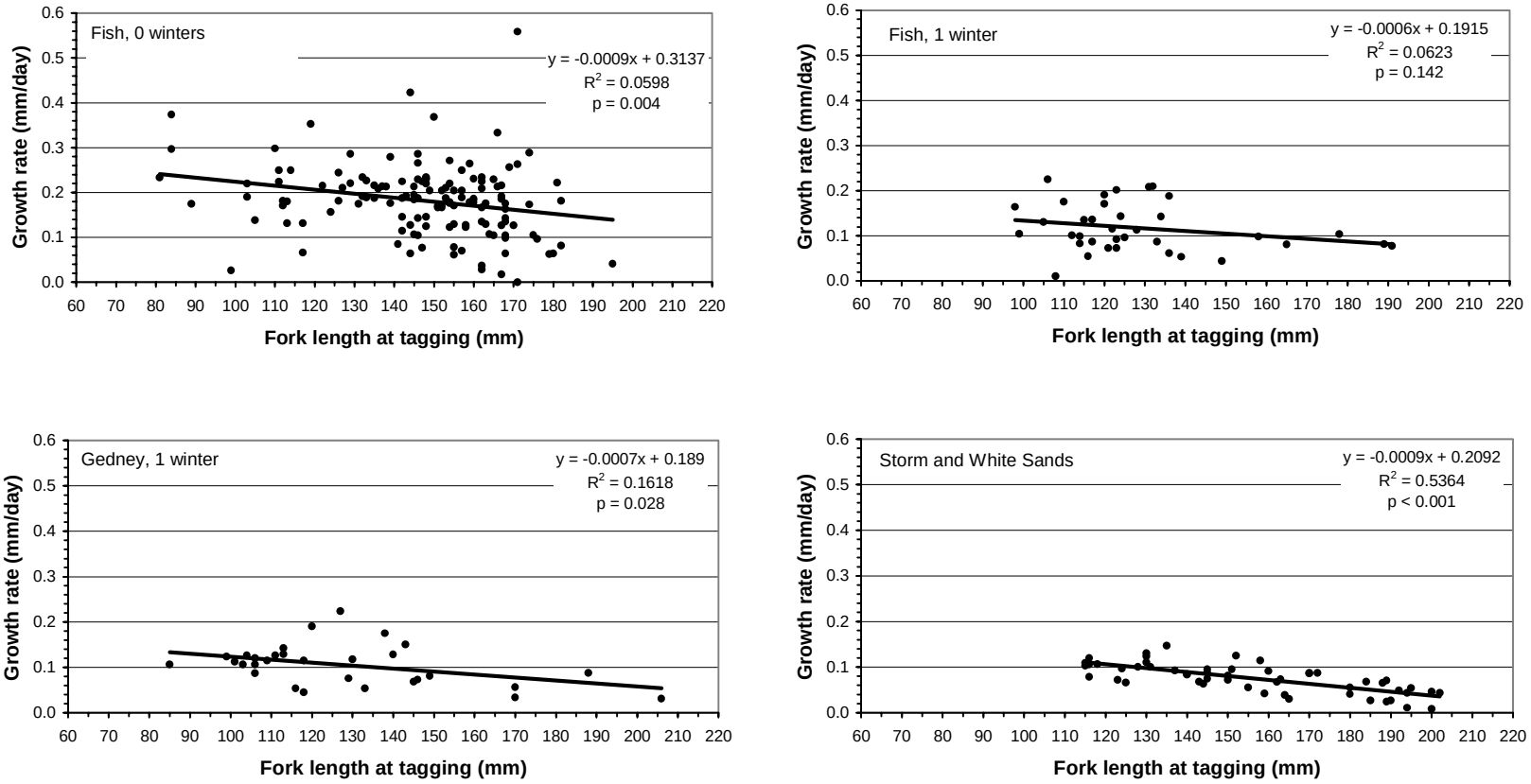
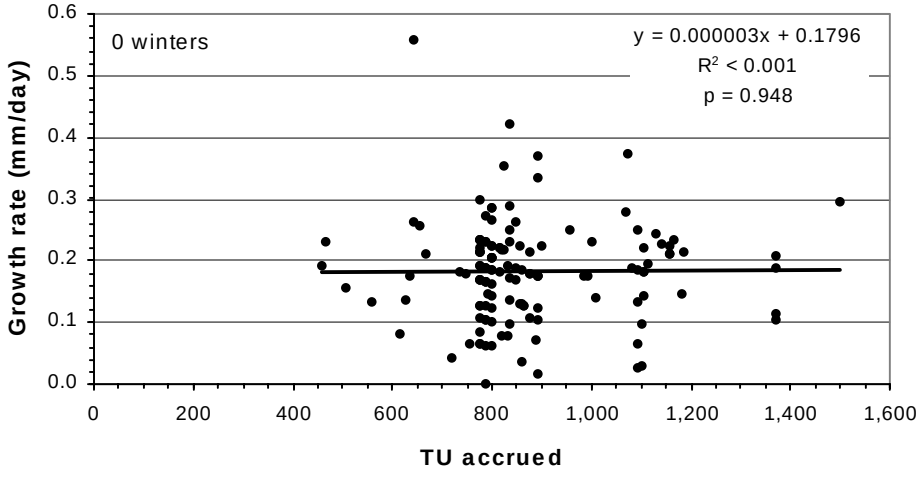


Figure 20. The relation between steelhead growth rate (mm/day) and fork length at first capture of fish that were recaptured in 2000 and tagged in 2000 in Fish Creek (Fish, 0 winters), tagged in 1999 in Fish Creek (Fish, 1 winter), tagged in 1999 in Gedney Creek (Gedney, 1 winter), and tagged in 1999 in Storm and White Sands creeks (Storm and White Sands, combined data).



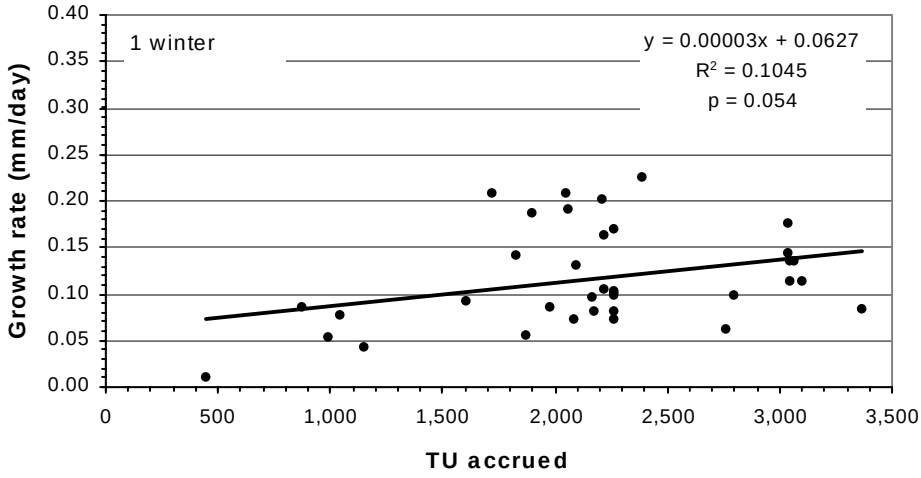


Figure 21. The relation between growth rate and temperature units (TU) accrued in Fish Creek of wild juvenile steelhead that were tagged and recaptured in 2000 (top graph, 0 winters) and fish recaptured in 2000 that were tagged in 1999 (bottom graph, 1 winter).

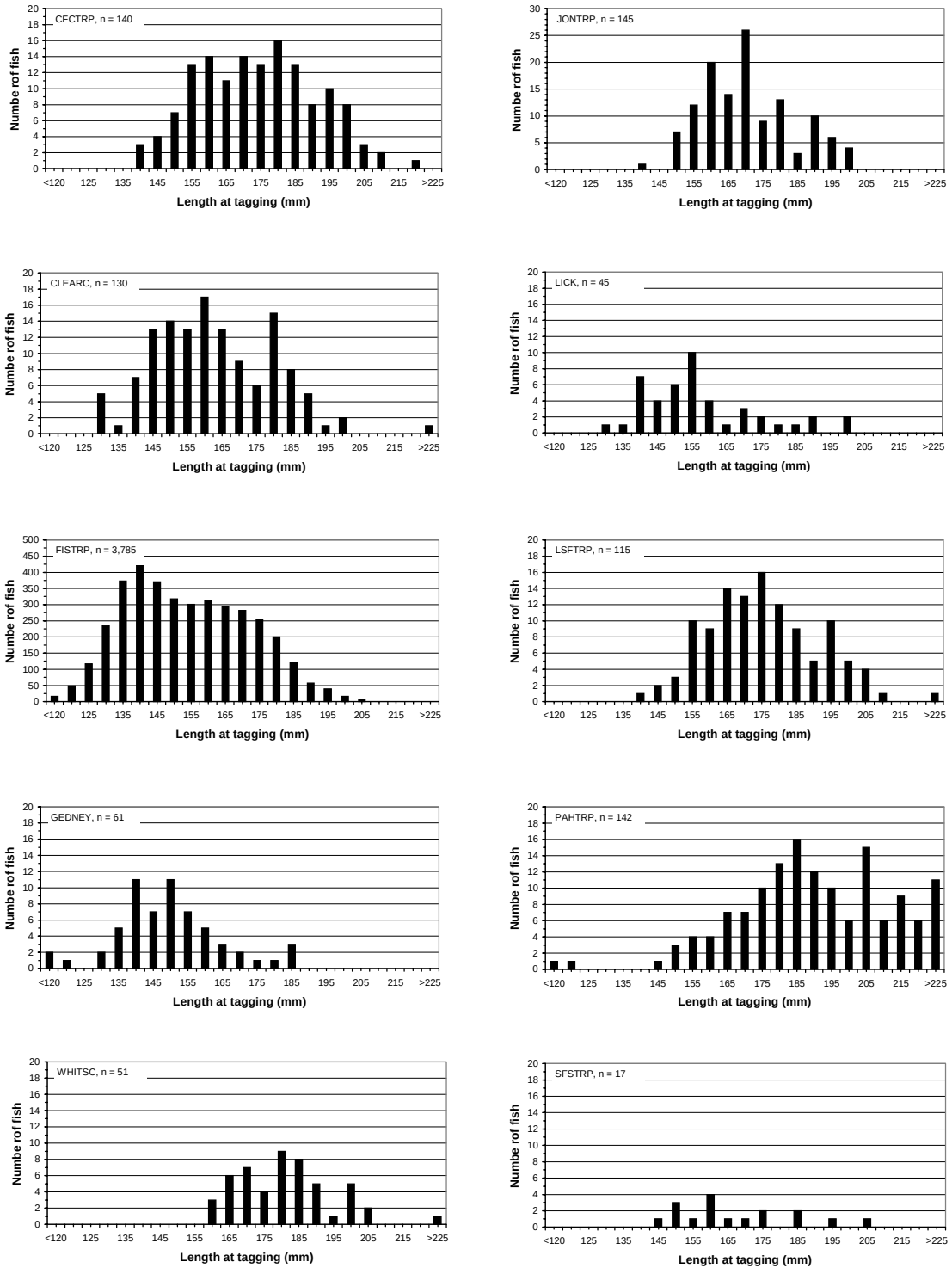


Figure 22. The length frequency of wild steelhead smolts that were tagged from August 15, 1999 to May 31, 2000 and detected during MY 2000. CFCTRP = Crooked Fork Creek; CLEARC = Clear Creek; FISTRP = Fish Creek; GEDNEC = Gedney Creek; JOHTRP = Johnson Creek; LICKC = Lick Creek; LSFTRP = Lower SF Salmon River; PAHTRP = Pahsimeroi River; SFSTRP = SF Salmon River at Knox Bridge, and WHITSC = White Sands Creek.

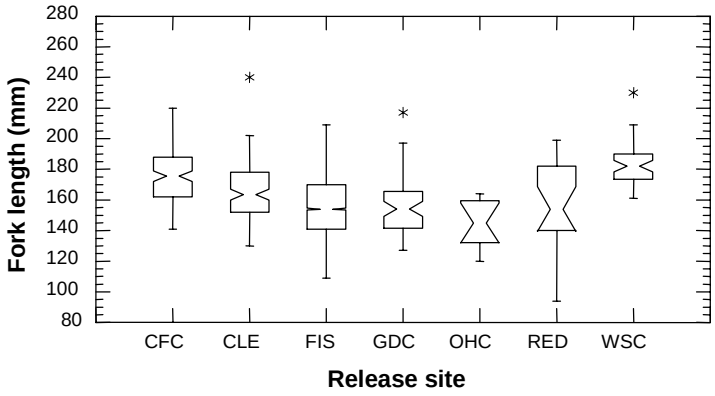


Figure 23. Box plot of length at the time of tagging of wild steelhead smolts from the Clearwater River drainage that were detected in 2000 at Snake and Columbia River dams. Fish were tagged between August 15, 1999 and May 31, 2000. CFC = Crooked Fork Creek; CLE = Clear Creek; FIS = Fish Creek; GDC = Gedney Creek; OHC = O'Hara Creek; RED = Red River; WSC = White Sands Creek.

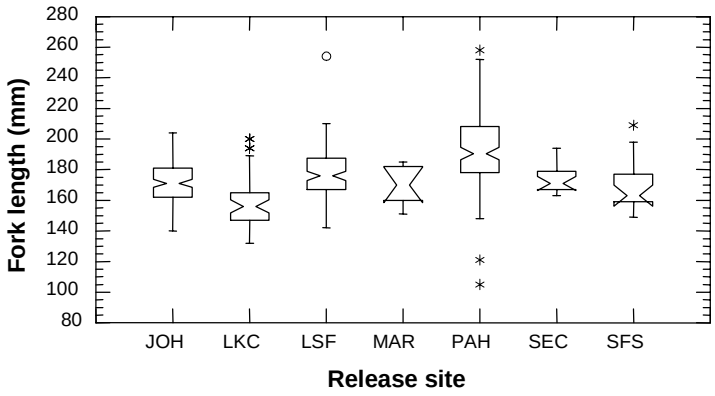


Figure 24. Box plot of length at the time of tagging of wild steelhead smolts from the Salmon River drainage that were detected in 2000 at Snake and Columbia River dams. Fish were tagged between August 15, 1999 and May 31, 2000. JOH = Johnson Creek; LKC = Lick Creek; LSF = Lower SF Salmon River; MAR = Marsh Creek; PAH = Pahsimeroi River; SEC = Secesh River; SFS = SF Salmon River.

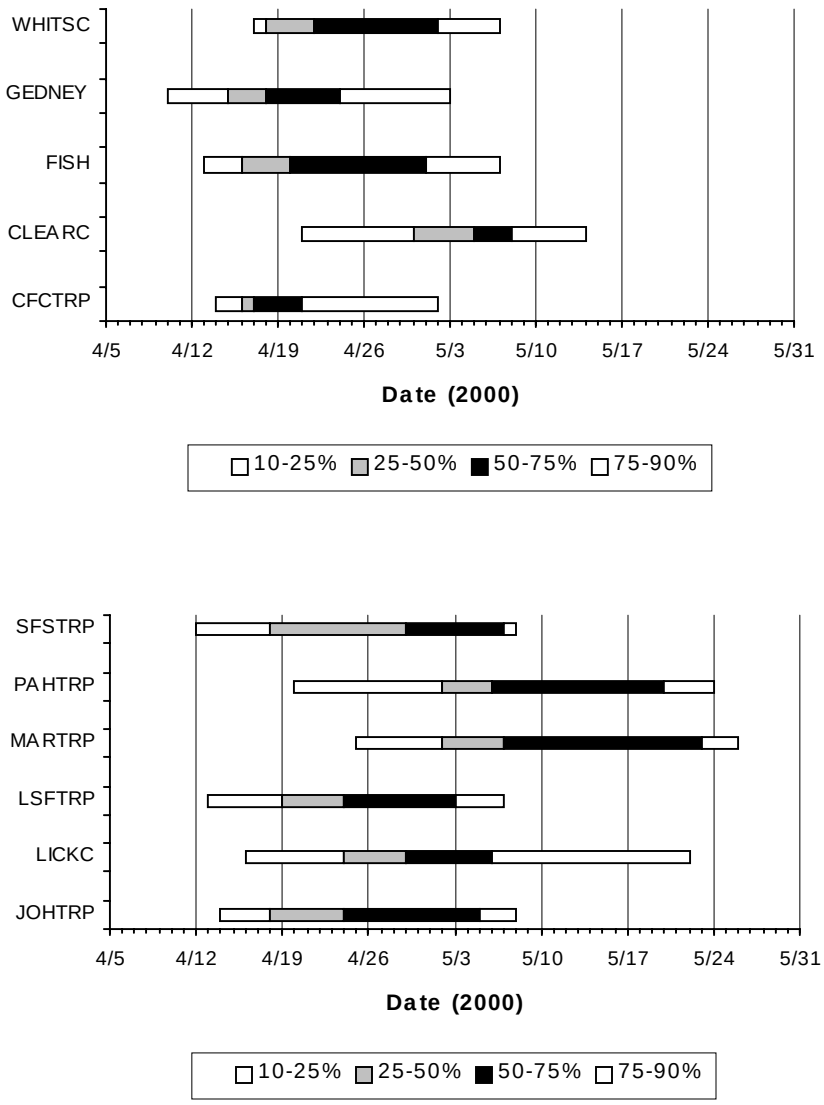


Figure 25. The date that 10%, 25%, 50%, 75%, and 90% of the total number of steelhead detections at Lower Granite Dam in 2000 was attained from tributaries of the Clearwater River (top graph) and Salmon River (bottom graph). The left edge of each block is the date that the lower quantile of the block was reached. CFCTRP = Crooked Fork Creek, CLEARC = Clear Creek, FISH = Fish Creek, GEDNEY = Gedney Creek, WHITSC = White Sands Creek, JOHTRP = Johnson Creek, LICK = Lick Creek, LSFTRP = Lower SF Salmon River, MARTRP = Marsh Creek, PAHTRP = Pahsimeroi River, and SFSTRP = SF Salmon River at Knox Bridge.

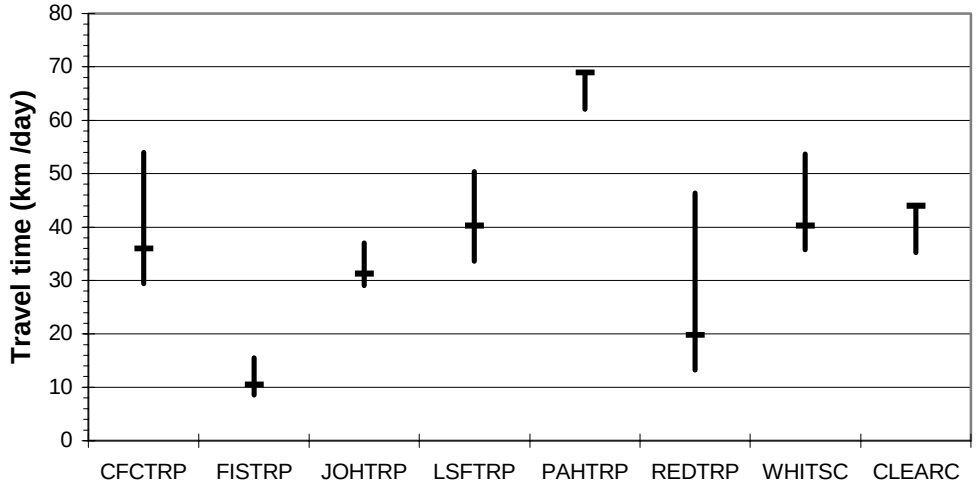


Figure 26. The median travel time (km/day) and the 90% CI from release site to Lower Granite Dam of smolts that were tagged during the spring 2000. CFCTRP = Crooked Fork Creek; FISTRP = Fish Creek; JOHTRP = Johnson Creek; LSFTRP = Lower SF Salmon River; PAHTRP = Pahsimeroi River; REDTRP = Red River, WHITSC = White Sands Creek, and CLEARC = Clear Creek.

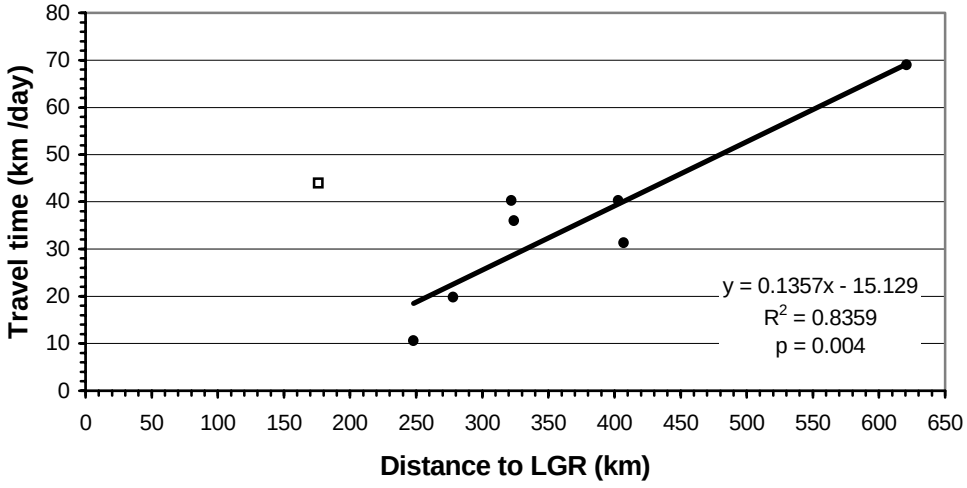


Figure 27. The relation between smolt travel time from tag site to Lower Granite Dam (LGR) and the distance to LGR. The data point for Clear Creek (open square) was omitted from the regression.

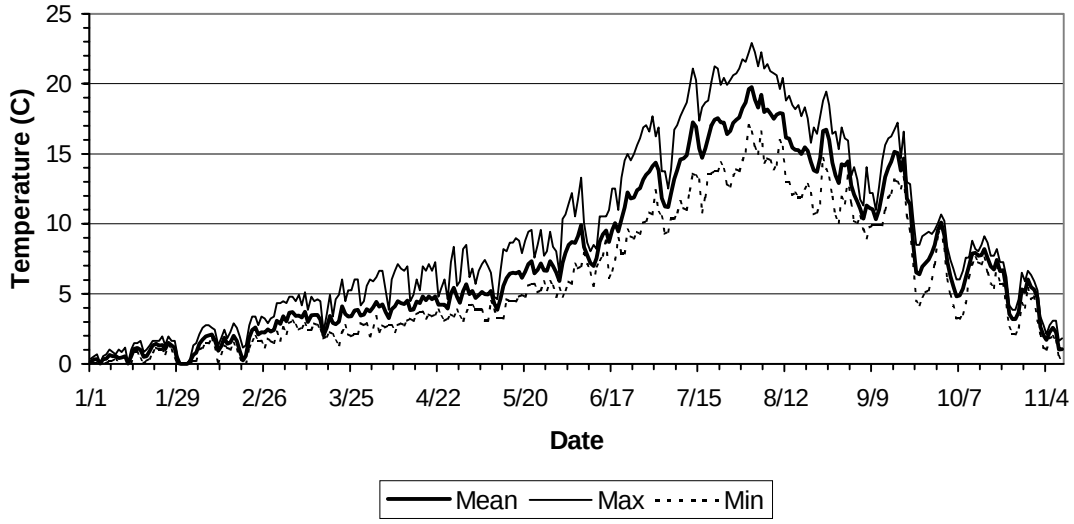


Figure 28. The daily mean, maximum, and minimum stream temperature in Fish Creek at the screw trap site from January 1, 2000 to November 10, 2000.

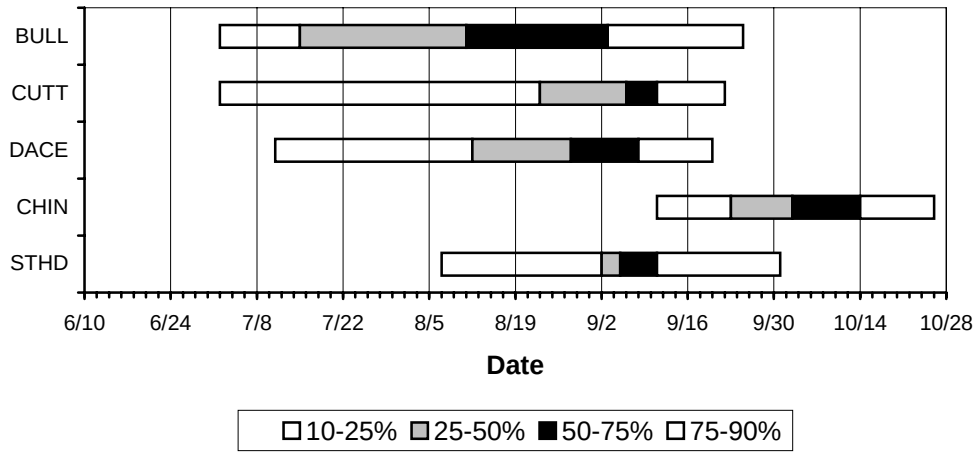


Figure 29. The date that 10%, 25%, 50%, 75%, and 90% of the total number of bull trout (BULL), cutthroat trout (CUTT), dace (DACE), and chinook salmon parr (CHIN) that were captured at the Fish Creek screw trap in 2000 was attained. The steelhead (STHD) quantiles are for the number tagged that were captured in the screw trap. The left edge of each block is the date that the lower quantile of the block was reached. The longnose dace, shortnose dace, and unidentified dace data was combined for this plot.

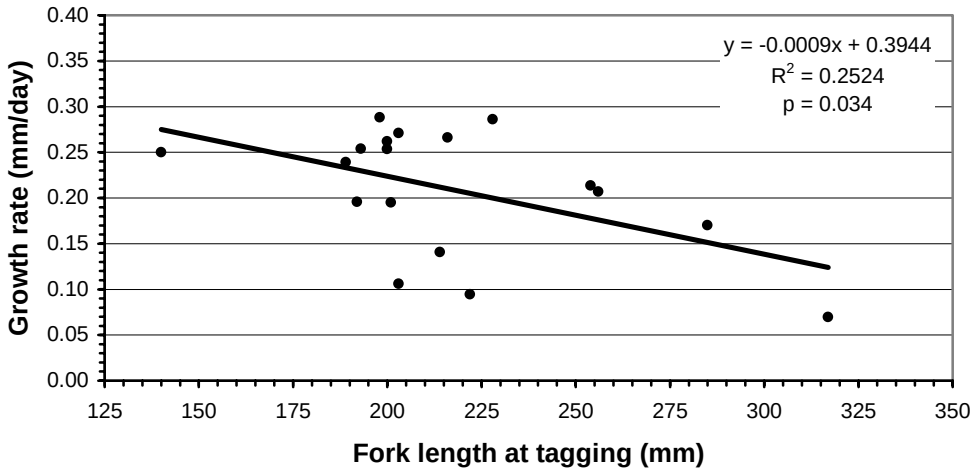


Figure 30. The relation between growth rate and length at first capture of cutthroat trout that were recaptured in Fish Creek in 2000. All recaptured cutthroat trout were tagged in Fish Creek during 1999 and 1998.

APPENDICES

Appendix 1. The number of adults that were handled at the Fish Creek weir (trapped in live box, marked, and passed upstream plus the number of unmarked kelts recovered) from 1992 to 2000. The date breached column is the date the weir was breached from high flow and fish could pass the weir freely thereafter. The mean proportion column is the average proportion of adults that had passed the weir in the years 1993, 1994, 1998, and 2000 on the date the weir was breached. I omitted 1992 because there were many openings in the weir that year and most adults were handled as kelts. The additional adult column is the estimated number of fish that entered the stream after the weir was breached, except in 2000. In 2000, the maximum likelihood estimate of the total escapement was 29; hence, the additional adult column is the number of fish that passed the weir unhandled. NB = not breached; weir was intact for the entire spawning run.

Year	Date Breached	Adults Handled		Mean Proportion	Additional Adults	Estimated Escapement
		Males	Females			
1992	NB	27	78	-	0	105
1993	NB	63	204	-	0	267
1994	NB	33	37	-	0	70
1995[a]	May 2	15	17	0.552	26	58
1996	May 18	11	21	0.859	5	37
1997	May 11	9	11	0.742	7	27
1998	NB	27	47	-	0	74
1999	May 24	14	58	0.951	4	76
2000	NB	11	15	-	3	29

[a] The weir was opened on May 2, 1995 to prevent otter predation. We kept the weir open for the remainder of the spawning season so adults and kelts could pass the weir freely.

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